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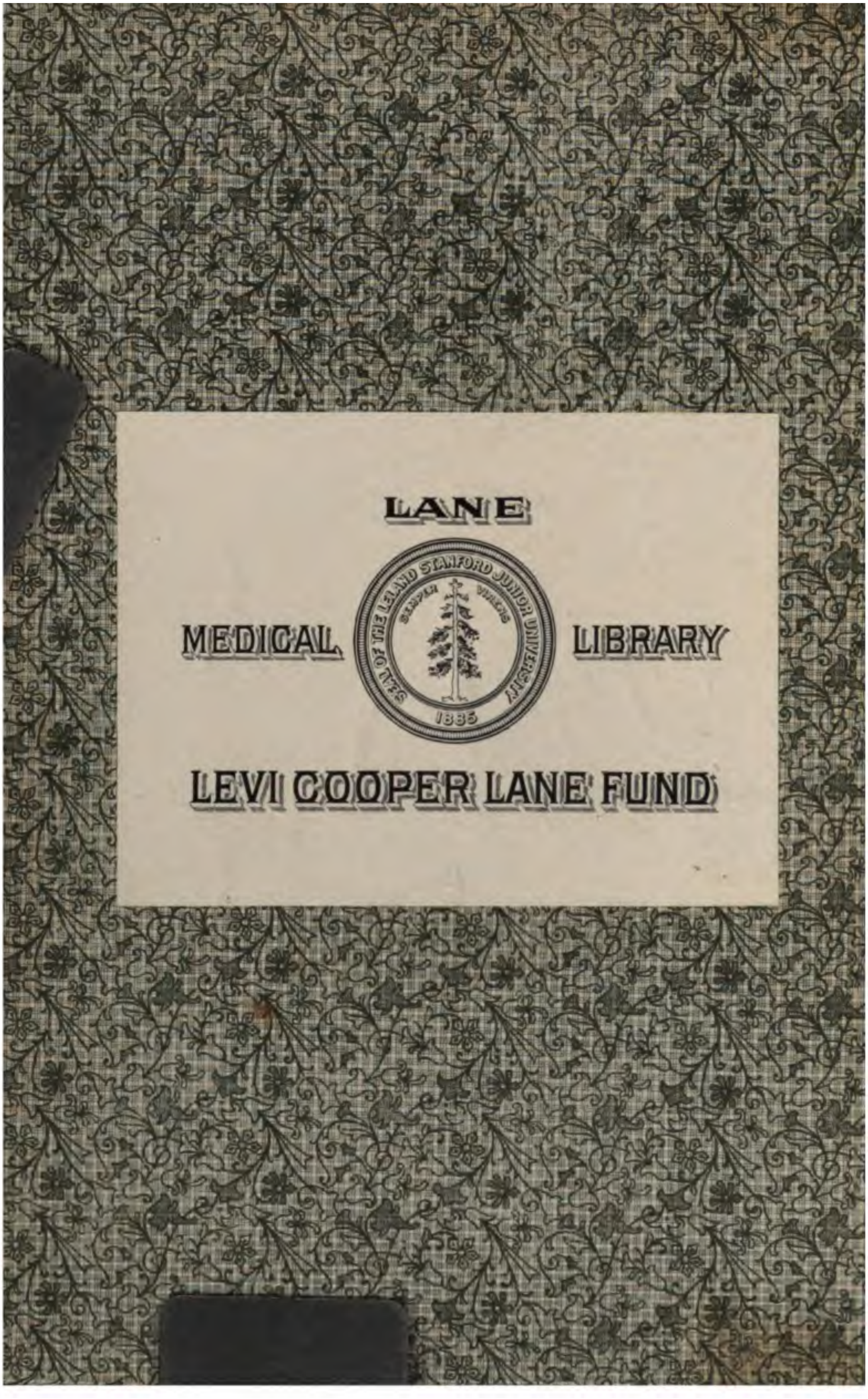

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A SYSTEM OF GYNÆCOLOGY

A

SYSTEM OF GYNÆCOLOGY

BY MANY WRITERS

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PREFACE

PROGRESS has been so rapid in the department of gynæcology during the ten years which have elapsed since this *System* was first published, that in preparing the present volume it has been found necessary to rewrite the greater part of it. In its surgical aspects, during the past decade, gynæcology has grown almost out of knowledge. The authors of the two chief surgical articles in the first edition, viz. Ovariotomy and Hysterectomy, have been removed from us by death, and the articles by Prof. J. W. Taylor and Prof. H. R. Spencer, which take their place, are entirely new. Additional surgical articles dealing with Antiseptic and Aseptic Technique, Minor Operations upon the Uterus, Vaginal Hysterectomy and Colpotomy, and After-Treatment of Gynæcological Operations, have also been found necessary. The article on Plastic Gynæcological Operations, although not rewritten, has been extensively modified. We believe that these articles will prove to be fairly representative of the established surgical practice of British gynæcologists of the present day.

In its clinical and pathological aspects also, gynæcology has not been stationary. In the case of certain subjects, such as Pelvic Hæmatocele and Diseases of the Ovary, such rapid advances have been made as to call for entirely new articles; and certain other subjects, such as Chorionepithelioma and Gonorrhœal Infection, are now included for the first time.

Three of the articles in the first edition have been omitted altogether; and eighteen are now republished after careful, and, in

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some instances, laborious revision, in order to bring them fully abreast of modern theory and practice.

We gladly acknowledge the willingness which all our collaborators have shown to accept suggestions as to the scope of their articles; but except in this respect no attempt has been made to influence them in their work, and accordingly the responsibility for the opinions expressed rests upon the writers of the articles alone.

The late Editor, in his preface to the first edition, spoke of the conservatism of British gynæcological practice and the contrast it presents to the adventurousness of our American and Continental brethren. On the whole, we agree with the view that this is not to be regretted. But the careful student of the work of foreign gynæcologists may be inclined to think that our conservatism sometimes leads us to pay less attention to recent innovations than is justly due to them, and in consequence to retain old methods, in spite of their obvious disadvantages, because they have served us well, and to reject new ones which others have found better. It is possible that the critic may find some justification for this view in the present volume, and even the friendly reader will clearly perceive that, although great progress can be recorded, the lapse of ten years has left the conservative tendencies of British gynæcological practice unchanged.

T. C. A.
T. W. E.

PREFACE TO THE FIRST EDITION

In the earlier treatises on medicine diseases of women were included, but were of necessity imperfectly described.

Of late years this department of medicine has grown so largely that the Editor of the new *System of Medicine* found it would be better to deal with it, as a whole, in a volume especially devoted to the subject; in the preparation of this volume I have assisted him as Joint Editor.

The advances made within the last few years in Gynæcology are perhaps more remarkable than in any other branch of medicine.

The whole subject is one of recent development. Even the work of its pioneers is within the recollection of the older amongst us: a treatise on Gynæcology written twenty years ago is absolutely useless as a guide to the practice of to-day, and does not contain even a reference to many of the topics now known to be of primary importance in connection with diseases of the reproductive organs in women; on the other hand, many opinions and methods of treatment, then largely taught and practised, have justly passed into oblivion.

Much of this great progress is undoubtedly on the surgical aspect of the subject. The increasing frequency of abdominal sections has directed attention to the diseased states thus revealed, and to methods of treating them, previously quite unknown.

Unbalanced zeal has had its inevitable result of injudicious practice, which is to be regretted; against adventure of this kind protests have been made by the more conservative-minded members of our profession, often justly, sometimes unjustly. Nor is it in this country alone that this adventurousness is seen. Any one familiar with current gynæcological practice, both on the Continent and in the United States, must know that the same spirit is active there. Indeed, it is probable that gynæcologists abroad are apt to impute to their British colleagues a backwardness in adopting methods of treatment largely practised by themselves; many of us think, too largely. Conservatism of this sort may have its faults, but, on the whole, it is not to be regretted, and it is surely better than to err in the opposite direction.

It is obvious that a collection of independent essays, written by men on topics which they have specially studied, must carry more weight, and be more useful, than any work compiled by a single writer. An endeavour has been made to entrust the several subjects to thoroughly representative men; and it is hoped that the results of their combined labours will give an accurate exposition of gynæcology as it is taught and practised amongst us.

I am myself alone responsible for the selection of the contributors, which my co-editor has left to my judgment; but I am not in any way responsible for the opinions they have expressed,—some of them, indeed, I do not share.

In a work by various authors differences of opinion will necessarily be found; some condemn methods of practice which others approve and recommend. This does not appear to be objectionable; it is surely better that in vexed and disputed questions both sides should be fairly considered.

W. S. PLAYFAIR.

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THE DEVELOPMENT OF MODERN GYNÆCOLOGY

GREAT as the progress has been during the last fifty years in every domain of medicine, in no department has it been more marked than in that which embraces the diseases peculiar to women. Indeed, in tracing the developments of modern gynæcology, it is difficult for the student of our times to estimate the value of each claim to progress, and to set a just price on each alleged advance; for it must be allowed that among many brilliant achievements, many false starts have been made; and the boasted triumph of yesterday has been ranked among the failures of to-day.

Sir William Priestley, in his address before the section of Obstetrics and Gynæcology,[1] says: "Looking back on forty years of gynæcological practice, I can recollect what has been termed a craze for inflammation and ulceration of the os and cervix uteri. During its prevalence, it was said of some devotees that every woman of a household was apt to be regarded as suffering from these affections, and locally treated accordingly. Shortly afterwards came a brief and not very creditable period when clitoridectomy was strongly advocated as a remedy for numerous ills. This, fortunately, had a very limited currency and was speedily abandoned. Then followed a time in which displacement of the uterus held the field, and every backache, every pelvic discomfort, every general neurosis, was attributed to mechanical causes, and must needs be treated by uterine pessaries. Again, we had an epoch when oöphorectomy was not only recommended, and largely practised as a means of restraining hæmorrhage in bleeding fibroids, but also as a remedy for certain forms of neurosis, even when the ovaries were healthy or not seriously diseased. Ere long it was discovered that removing the ovaries for neuroses, even if safely accomplished as far as life was concerned, was frequently followed by more serious nervous penalties than those for which it had been used as a remedy; that, in fact, it often entailed a loss of mental equilibrium, and sometimes ended in insanity. Close upon this, again, came an ardour for stitching up rents in the cervix uteri following child-birth, rents which were described as producing many hitherto unknown evils, and as frequently conducing to the establishment of malignant disease. Lastly, we have had what has been described as an epidemic of operations for the excision of the uterine appendages; and even now, though this operation has but recently come into vogue, there is a reaction against its too frequent performance, and a demand in its place for more conservative methods, which shall leave these parts of the generative system a chance of still performing their important functions."

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[1] Brit. Med. Assoc. 1895.

Whatever may have been the mistakes in the past, it is certain that the accurate knowledge and fuller certainties of the present day have been won by anatomical and pathological research, and by patient clinical observation in both the sick-room and the operating theatre.

It will always be a pleasant task to acknowledge the deep debt of gratitude which gynæcology owes to Lord Lister; for without his scientific discoveries and brilliant teaching, the successes of modern pelvic and abdominal surgery could never have been won.

The groundwork of all true development in any branch of medical science must lie in the establishment of an accurate knowledge of anatomical detail, and a correct appreciation of pathological changes. It may accordingly be well to review the advance of our knowledge in these subjects; and first in anatomy.

Anatomy.—*The blood-supply of the uterus*, by the uterine and ovarian arteries, has been well known and described by anatomists for many years past; but the manner in which the blood is distributed to the organ has been less minutely studied, and until Sir John Williams wrote his classical paper "On the Circulation in the Uterus, with some of its Anatomical and Pathological Bearings," our knowledge of this important subject was extremely imperfect. Sir John Williams pointed out that the provision for the flow of blood into, and out of, the uterus is such, that the process can with difficulty be disturbed by mechanical causes. The entrance and the exit take place at numerous points at the sides of the organ, and not at its extremities; while in the uterus the direction of the current is transverse to its length and perpendicular to its surface; a ligature might therefore be placed round the uterus at any point without affecting the circulation above and below. The only ligature which could materially interfere with the flow of blood into the uterus, or out of it, is one surrounding the broad ligaments (their upper borders being included within it), together with a portion of the uterus. In this case the inflow to the parts above or within the ligature, and the outflow from them, would be diminished or stopped. Conditions similar to this are found when the uterus forms a hernia, either in the inguinal canal or in the pouch of Douglas.

There is another condition which may also be described as a form of hernia, namely, procidentia. Here all the veins of the broad ligaments may be so stretched that their lumina are considerably diminished, and all the channels for the return of blood from the uterus so narrowed that the organ must consequently suffer from passive congestion. These varieties of hernia of the uterus and especially severe procidentia, appear to be the only displacements of the uterus which can give rise to congestion.

To those who remember the period in the development of gynæcology when uterine displacements were made to explain endless ills, it will be clear that the publication of the above essay made an enormous difference in the value attributed to so-called mechanical causes. Nowadays a more rational view is taken of the importance of alterations or deviations from the ordinary position of the womb; and it is recognised that very considerable changes in the position of the uterus are perfectly compatible with the enjoyment of excellent health. The outcome on the clinical aspect is easy to imagine; pessaries are no longer recklessly inserted for every slight misplacement, but are reserved for those more severe cases in which relief to an embarrassed circulation is clearly called for.

The pelvic peritoneum.—Good work has been done in recent years by those who have increased our knowledge of the anatomical and obstetric aspects of the pelvic peritoneum. Thus Polk and Barbour have shown that in the full-term pregnant uterus the peritoneum in front and behind has the same relations as in the non-gravid uterus; whereas at the sides the peritoneum is so lifted up by the growing uterus that the base of the broad ligament is on a level with the pelvic brim. Stephenson concludes that the ligamental portions of the pelvic peritoneum offer considerable and permanent resistance to stretching beyond the limits of their elasticity; and that the tension thus thrown on them is sufficient to undo their attachment to the pelvic walls. The peritoneum covering the uterus, however, instead of borrowing from neighbouring parts, undergoes a gradual yielding to an unlimited extent—growth supplying the additional material necessary to prevent thinning. The contrast is great between the unlimited expansion of the uterine peritoneum, under the gradual increase in bulk of the ovum, and its intolerance of a rapid dilating force—a contrast aptly illustrated by the possibility of rupture of the uterus on injecting a few ounces of water for induction of premature labour. The peculiar property of the uterine peritoneum of yielding gradually under a small but persistent force, confers upon it something of a plastic character.

The connective tissue of the pelvis.—We are greatly indebted to the good work done by Hart and Barbour for our accurate knowledge of the manner in which the connective tissue of the pelvis is distributed. This tissue lying subperitoneally, surrounding the cervix uteri, and spreading out between the layers of the broad ligament, is of the highest pathological importance, as in it, and in the pelvic peritoneum, occur those inflammatory exudations so common in women. Of late years our knowledge of the disposition of this tissue has been rendered much more accurate; and, accordingly, our discrimination of pelvic inflammatory attacks made much more precise. The most valuable information is obtained by studying sections of frozen pelves. This method gives the precise position of the tissue, its amount and distribution. By injections of air, water, or plaster of Paris, we have learnt the varying attachments of the pelvic peritoneum to the subjacent tissue, and the lines of cleavage, as it were, of the pelvic connective tissue along which pus will burrow. The experiments of Bandl, König, and Schlesinger have taught us many valuable lessons.

1. Water injected between the layers of the broad ligament, high up in front of the ovary, passes first into the tissue lying at the highest part of the side wall of the true pelvis. It then passes into the tissue of the iliac fossa, lifting up the peritoneum, and follows the course of the psoas, passing only slightly into the hollow of the iliac bone. Lastly, it separates the peritoneum from the anterior abdominal wall for some little distance above Poupart's ligament, and from the true pelvis below it.

2. On injection beneath the broad ligament to the side and in front of the isthmus, the deep lateral tissue becomes filled first; then the peritoneum becomes lifted up from the anterior part of the cervix uteri; thence the separation passes first to the tissue near the bladder, and ultimately along the round ligament to the inguinal ring. There it separates the peritoneum along the line of Poupart's ligament, and passes into the iliac fossa.

3. An injection of the posterior part of the base of the broad ligament fills the corresponding tissue round Douglas's pouch, and then passes on as described in the first section.

Much might be written to show what extensive work has been done to perfect our knowledge of the sectional anatomy of the female pelvis, of the structural anatomy of the pelvic floor, and of the position of the uterus and its appendages; but the work already quoted will illustrate how full a share anatomy has had in the development of gynæcology.

Pathology.—Turning from the anatomical to the pathological aspect, it is interesting to note that the enormous strides which gynæcology has made, and which have raised it from a collection of desultory hypotheses to its present high position, have all been taken in the last half-century. It is true that in the early part of the 19th century Récamier was advocating the use of the speculum and sound, and by his writing and teachings was giving an impulse to the study of uterine pathology; but it was not until about the year 1840, when Simpson in England and Huguier in France took the field with so much warmth, vigour, and originality, that a new interest was awakened and the future of gynæcology assured.

Récamier, Lisfranc, Kiwisch, Huguier, Simpson, and others had already paved the way for further discoveries, when H. J. Bennet published in 1845 the first edition of his work on *Inflammation of the Uterus*, and roused the attention of the profession in every country to the pathology which he there set forth. The chief points he insisted on were the following:—

1. That inflammation is the chief factor in uterine affections, and that displacements, ulcerations, and affections of the appendages follow from it.

2. That menstrual troubles and leucorrhœa are merely symptoms of this morbid state.

3. That in the vast majority of cases inflammatory action will be found to confine itself to the cervical canal, and not to affect the body of the uterus.

4. That the disease is properly attacked by strong caustics.

It is difficult for the modern student to apprehend the conflict of opinion which arose over these assertions of Bennet; it is sufficient to say that his views were strongly controverted by such able writers as Tyler Smith, Robert Lee, West, and others; and that in the present day few gynæcologists would be prepared to accept such statements. Thanks to the study of bacteriology, much evidence that in those days seemed misty and conflicting is read by us now in a totally different sense. The knowledge of septic organisms, of the influence of specific microbes, of the conditions of tissue-resistance, have opened out new ideas and new interpretations; and it is probably not too much to assert that had Bennet possessed our advantages much of his pathology would have been rewritten.

Another landmark in the history of the development of modern gynæcology was the publication by Tilt in 1850 of his book on *Ovarian Inflammation.*

The year 1854 marked a fresh epoch in the evolution of gynæcology; then it was that the great dispute over uterine displacements and pessary-manufacture began. Hodge in America, Velpeau in France, and Graily Hewitt in England, stood forth as champions of the immense importance of malposition of the uterus in the causation of pelvic disease. How strongly the idea was urged may be judged by Velpeau's statement:—"I declare, nevertheless, that the majority of the women treated for other affections of the uterus have only displacements; and I affirm that eighteen times out of twenty, patients suffering from disease of the womb or of some other part of this region—those, for instance, in whom they diagnose engorgements—are affected by displacements."

Graily Hewitt, again, showed in his writings and teachings the enormous importance he attached to displacements of the womb; in his well-known work on *Diseases of Women* he formulates the following opinions:—

"1. That patients suffering from symptoms of uterine inflammation are almost universally found to be affected with flexion, or alteration in the shape of the uterus—an alteration of easily recognised character, though varying in degree.

"2. That the change in the form and shape of the uterus is frequently brought about in consequence of the uterus being previously in a state of unusual softness, or what may be often correctly designated as chronic inflammation.

"3. That the flexion once produced is not only liable to perpetuate itself, so to speak, but continues to act incessantly as the cause of the chronic inflammation present."

For a long time the teaching of this epoch caused a vastly undue importance to be laid on the presence of every flexion or deviation, however slight. Every gynæcologist, or practitioner who claimed special gynæcological merit, felt himself called upon to invent a pessary, or to modify some one else's instrument; and if, to quote Prof. Clifford Allbutt, "the uterus could justly complain that it was always being impaled on a stem or perched on a twig," it certainly could not complain that there was want of variety in the stem or monotony in the contour of the twig.

Thanks to a more complete study of the circulation of the uterus by Williams, and to the teaching and practice of Matthews Duncan, a more correct appreciation of the importance of uterine displacement has been arrived at; and we can recognise that it is possible for the uterine axis, as for the nasal septum, to be somewhat deviated, without the patient's health being materially affected thereby. The value of a pessary in suitable cases is fully allowed; but the instrument is no longer thought to be a panacea for every pelvic ill, or even a justifiable *placebo* to soothe the patient when diagnosis is at fault.

Surgery.—The next great era in the progress of gynæcology dates from the establishment of ovariotomy as a recognised operation; for abdominal surgery, and especially that branch of it which had reference to disease of the uterus and its appendages, received its greatest impulse when it was found that ovarian cysts of the most formidable nature could be dealt with successfully and safely. Much discussion has arisen from time to time as to the author of the first successful ovariotomy; but it is now fairly certain that this honour rightly belongs to M'Dowell of Kentucky.

The record of this first operation is of interest; it was performed on a Mrs. Crawford of Kentucky in December 1809. The tumour inclined more to one side than the other, and was so large as to induce her professional attendant to believe that she was in the last stage of pregnancy. She was affected with pains similar to those of labour pains, from which she could find no relief. The incision was made on the left side of the median line, some distance from the outer edge of the rectus muscle, and was nine inches in length. As soon as the incision was completed the intestines rushed out upon the table; and so completely was the abdomen filled by the tumour, that they could not be replaced during the operation, which was finished in twenty-five minutes. In consequence of its great bulk, Dr. M'Dowell was obliged to puncture it before it could be removed. He then threw a ligature round the Fallopian tube near the uterus, and cut through the attachments of the morbid growth. The sac weighed 7½ lbs. and contained 15 lbs. of a turbid, gelatinous-looking substance. The edges of the wound being brought together by the interrupted suture and adhesive strips, the woman was placed in bed and put upon the antiphlogistic regimen. "In five days," says Dr. M'Dowell, "I visited her, and, much to my astonishment, found her engaged in making up her bed. I gave her particulars for the future, and in twenty-five days she returned home in good health, which she continues to enjoy." Mrs. Crawford lived until March 1841, and had no return of her disease. She enjoyed excellent health up to the time of her death. It must not, however, for a moment be supposed that the idea of ovariotomy originated with M'Dowell. Years before, the Hunters had shadowed forth the possibility of removing ovarian cysts; and John Bell of Edinburgh, though he had never performed ovariotomy, yet in his lectures dwelt with peculiar force and pathos upon the hopeless outlook of ovarian tumours when left alone, and upon the practicability of removing them by operation. From this time forward surgeons from time to time undertook the operation; sometimes a solitary case, attended by success or failure, sometimes a small group of cases (as published by Clay of Manchester in 1842) with a fair percentage of success were recorded; but still the operation had not secured the confidence of the profession, and the records were few and far between.

In 1850 Duffin inaugurated a new era by raising the question of the danger of leaving the tied end of the pedicle within the peritoneal cavity, and by insisting upon the importance of keeping the strangulated stump outside. Of this step in the history of ovariotomy Spencer Wells writes:—"Whatever may be our opinions and practice at the present time, and whatever views we may hold upon the question, whether this extra-peritoneal treatment of the pedicle has advanced or retarded the success of the operation, Duffin's arguments led to great changes and results—to the use of the clamp and to all the modifications of treatment attendant upon it, and ultimately to researches on the physiological and pathological phenomena of ligatured stumps within the peritoneal cavity, and to the study of the important subject of drainage by Koeberle and others."

Much might be said of the excellent work done by Baker Brown, and of his success with the cautery; also of Tyler Smith's revival of the practice of returning the ligated pedicle. But the history of the established and successful practice of ovariotomy dates from the publication of Spencer Wells's first book in 1864. From this time onward the operation has made continuous progress; step by step difficulties have been overcome, and each advance has been established on a sound scientific basis.

Ovariotomy, in the course of its evolution, taught us great things regarding the tolerance of the peritoneum, even of rough handling and injury, provided nothing septic be left for absorption. Many details of treatment employed at present in general abdominal surgery were learnt in the school of ovariotomy.

No educated surgeon will ever minimise our vast obligations to Lord Lister; but in fairness to the pioneers we may notice that Spencer Wells had taken steps at a very early period to prevent the exposure of his cases to noxious influences. He did not allow surgeons who had been in contact with septic cases to be present at his operations; he kept his wards for abdominal cases separated from wards in which patients with sloughing uterine cancer or other fœtid diseases were present; and he himself gave up all work in the post-mortem room.

If in describing thus far the growth of ovariotomy the names of many eminent pioneers—such as Clay of Manchester, Atlee of America, Keith, and numerous other workers—have received scanty recognition, it is because in the present article no attempt is being made to describe fully the evolution of ovariotomy, but only to show the place it took in the development of gynæcology, and to emphasise some of the principal teaching and the elaboration of details which secured for it its present successful position.

When once the removal of the ovaries in cases of cystic disease of these organs had become an established operation, it was to be expected that surgeons would consider the advisability of removing the uterine appendages for other morbid conditions; but no special move was made in this direction till about the year 1872, when we find that Hegar, Battey, and Lawson Tait all began to work in this special field. Battey's original idea was to remove ovaries, not in themselves diseased, for the cure of certain nervous diseases, which he believed to be caused, or kept up, by structural or functional derangements of the ovaries. Hegar must have the credit of introducing the removal of ovaries for the cure of fibromyoma of the uterus; while to Lawson Tait belongs the credit of introducing the operations for removal of diseased ovaries and tubes.

The revival of ovariotomy between 1858 and 1865 led, in the words of Paget, to an extension of the whole domain of peritoneal surgery. This extension, naturally enough, began with the removal of uterine tumours. The removal of fibromyomas of the uterus had always been a much more serious matter than the performance of ovariotomy. Thus up to the end of the year 1883, or thereabouts, such eminent operators as Schroeder, Martin, Tait, and Bantock had a mortality of 30 per cent, or even higher; and though Keith had shown that it was possible by improved methods and wider experience to have a mortality not much greater than that of ovariotomy, still the operation in the hands of the majority of surgeons had not given such satisfactory results. The greatest gain so far had been brought about by Hegar's suggestion of the removal of tubes and ovaries as a method of procuring arrest of growth and subsequent atrophy of these tumours.

It is not within the scope of this article to enter upon the various methods of operating for uterine fibroids, nor upon the various modifications of existing operations; but it is noteworthy that the most eminent gynæcological surgeons of the present day are not the most ardent advocates of frequent operating, but rather show their skill by their judicious selection of cases suitable for interference.

No account of the work done in the development of gynæcological surgery would be complete without a reference to the splendid achievements of Marion Sims in the field of *vesico-vaginal fistula*. In numbers of women life was rendered one long period of suffering and distress until Sims brought his skill to bear on the subject of these lacerations. From the days of Ambrose Paré attempts had been made by Lallemand, Gosset, Jobert de Lamballe, and many other surgeons, to find a satisfactory mode of closing these fistulas, but with what amount of success may be judged by the words of Velpeau, who, writing in 1839, says: "To abrade the borders of an opening, when we do not know where to grasp them; to shut it up by means of needles or thread, when we have no point apparently to secure them; to act upon a movable partition placed between two cavities, hidden from our sight, and upon which we can scarcely find any purchase, seems to be calculated to have no other result than to cause unnecessary suffering to the patient." In 1852 Sims brought out his perfected method of healing these rents in the floor of the bladder, and gained a series of successes which entirely altered the aspect of this special branch of surgery. He laid claim to three discoveries, namely, that he had produced a speculum which enabled an operator to explore the vagina perfectly; that he had found a suture which was not liable to set up inflammation or ulceration; and that, by the use of his catheter, the bladder could be kept empty during the healing of the fistula.

Sims was shortly afterwards followed by Simon of Germany, and to the efforts of these two workers we owe our present satisfactory knowledge of the subject.

Reference may be made here to certain other plastic operations which have been devised in connection with the vagina; for instance, plastic operations for lessening the calibre of the vagina, others for preventing prolapse of the uterus, plastic operations on the cervix, and so forth, but none of them has taken an established place. In the same category might be placed sundry operations which have been devised of late years for fixing the uterus; thus Alexander's operation of shortening the round ligaments in cases of uterine prolapse, hysteropexy or fixation of the womb to the anterior abdominal wall, detachment of the vagina from the anterior wall of the uterus, opening of the anterior peritoneal cul-de-sac, and forward fixation of the uterus—these and sundry other operations all have their earnest advocates, but it cannot be said as yet that they have secured the general confidence.

Extra-uterine Pregnancy.—One of the results of the recent advances in abdominal surgery has been to give us a wider acquaintance with the pathology and treatment of cases in which the fœtus is developed outside the uterine cavity. Much of our present knowledge is due to the investigation of Lawson Tait. Since Tait's first operation in 1883 for ruptured ectopic gestation—an operation which he performed successfully—great attention has been directed to the subject, and much advance in our knowledge has been made. Before this epoch extra-uterine gestation was thought to be one of the rarest events in the pathology of pregnancy; now we know that the accident is one of common occurrence.

In a paper read before the Royal Medical and Chirurgical Society of London, Mr. Bland-Sutton drew attention to the fact that the ovum in a case of tubal pregnancy, like the ovum in uterine pregnancy, is liable to become converted into a mole (apoplectic ovum). In November 1892 the same author brought a communication on "Tubal Moles and Tubal

Abortion" before the Medical Society of London, and by his admirable drawings and accurate research added greatly to our knowledge of this important condition. Since the discovery of the tubal mole, specimens of occluded Fallopian tubes filled with blood, independent of tubal pregnancy, are now found to be infrequent. In the last report of the Museum of the Royal College of Surgeons (1892) a description is given of "an equivocal example of hæmatosalpinx." This is a fair indication of the revolution which has taken place in our knowledge of the early stages of tubal pregnancy.

Malignant Diseases.—The ancient writers were doubtless acquainted with cancer of the uterus, but their knowledge was very vague; we may certainly claim that in the last fifty years we have made great advances in our knowledge of the pathology and clinical course of malignant diseases of the female genital organs. It is a matter of extreme regret that we have hitherto made so little progress in our modes of treatment, and are still so far from an acquaintance with any curative method.

Even in the earlier part of the present century the knowledge of *uterine cancer* was very shadowy; for Church, writing in 1864, says: "If we compare the writings of different persons—and those men of great experience—we shall find many points of interest undetermined, and others the subject of incessant controversy. Very frequently the description of the disease conveys only a lively picture of the uncertainty of the writer; and so vague, indeed, is the sense in which the term cancer is sometimes applied, especially by the French authors, that it would be quite impossible to recognise the complaint from their description." Denman fully appreciated the uncertainty of the description generally given. He says: "Of cancer it is to be lamented that we have at present neither a tolerable definition nor a correct history, nor any accurate distinction of the several varieties which are certainly known to exist. Nor is it yet proved whether cancer of any part has any specific quality according to the structure of the part affected, nor have we, in fact, any other idea than that it is an incurable disease. Till within quite recent years cancer was often confounded with fibroid tumour of the uterus, and the division into schirrus, encephaloid, epithelioma, and colloid was commonly quoted in the text-books of the day. Moreover, the term 'corroding ulcer' was applied by Dr. John Clark to a form of ulcer of the cervix in which nothing but rapid destruction of tissue is noticed as a pathological lesion, in which there is no hardness of the part affected, no induration nor inflammation of surrounding organs—nothing but molecular death in the cervix uteri, and disappearance of its structure as by liquefaction. It has been described under the name of rodent ulcer, diffuse ulcerative cancer, epithelial cancer, and cancroid of the uterus." Many other authors might be quoted to show how little certainty existed.

A decided step in advance was taken when Thiersch and Waldeyer laid it down that all cancerous disease in the uterus takes its origin from the epithelium lining the glands which dip down into the parenchyma.

"Only Thiersch, and recently Waldeyer," says Billroth, "maintain as I do the strict boundary between epithelial and connective tissue cells. I only call those tumours true carcinomata which have a formation similar to that of true epithelial glands (not the lymphatic glands), and whose cells are mostly actual derivatives from true epithelium." At one time surgeons were doubtful whether malignant disease arose more often in one part of the uterus than another; but another advance was made when Charles Clark wrote that "carcinoma particularly affects glandular parts, and the cervix of the uterus being the most glandular part of it, is probably the reason why it becomes more liable to this disease than any other part of the viscus."

Before this time Burns had laid down in his work that "as opportunities are not frequent of examining the womb in the early stage of the disease, and as in course of time it involves parts not at first affected, we have not yet decided what the comparative liability of different parts of this viscus is to the disease." Virchow advanced our knowledge still further by his investigations into the differences between malignant cauliflower excrescences and non-malignant papilloma. He stated his belief that some tumours, in every respect resembling vegetating epithelioma, are really non-malignant papilloma. The difference between the latter and real epithelioma is to be found by microscopic examination of the submucous tissue, which in the one case is healthy, in the other case diseased. In 1888 Williams published his well-known Harveian Lectures on uterine cancer, and summed up fairly the extent of our knowledge at that time.

No description of the evolution of this subject would be complete without reference to the admirable work done by Ruge and Veit in investigating the true nature of granular erosions of the cervix, and in showing how these lesions differ from early manifestations of true cancer. An erosion differs from cancer in that the epithelium on its surface and lining its glands consists of a single layer, and assumes no aberrant forms; and from adenoma of the cervix, in that the glands are comparatively superficial.

Sarcoma uteri.—Very little was known about this affection by the early authors of the last century. Reference is found in gynæcological literature from time to time to certain forms of fibroid tumours which had a tendency to return after removal, and the name "recurrent fibroid" was often used. Sir James Paget put these tumours into three divisions, namely, (1) malignant fibrous tumours, (2) recurrent fibroids, (3) myeloid tumours. Lebert described them as fibro-plastic tumours, and Rokitansky gave them the title of fasciculated cancer. Virchow was the first to give a clear and intelligent description of these growths, and to put them under the head of sarcoma. Gusserow and other observers in Germany, following in the steps of Virchow, have of late years given careful study to uterine sarcoma. Resembling, as it does, cancer of the uterus in many respects, there are certain well-established points of clinical distinction between them. At one time it was thought that the disease always arose in the body of the uterus, and never began primarily in the cervix; but this has now been shown by Veit and others to be a mistake, though of course the large majority of cases are of the former variety. Primary sarcoma of the uterus occurs anatomically and clinically in two distinct forms, namely, (1) fibro-sarcoma, which forms a more or less firm, circumscribed, rounded tumour growing from the uterine parenchyma; and (2) diffuse sarcomatous tumours growing from the connective tissue of the uterine mucous membrane, and composed mostly of small round cells.

In relation to malignant disease of the uterus, a very interesting disease known under the name of Deciduoma Malignum or Chorion-epithelioma now takes a recognised place. For a long time the pathology of this disease was indefinite, but it is now definitely settled, and a full account of all the questions involved will be found in the special article devoted to the subject (*vide* p. 382).

No great advance has been made in our knowledge of malignant affections of the vagina and vulva; but the paper of Matthews Duncan on "Lupus of the Vulva," published in the 27th volume of the *Transactions of the Obstetrical Society of London*, has materially advanced our knowledge of this rare disease. In this communication Duncan pointed out that though vulvar lupus lacks many of the histological characters of lupus vulgaris, yet in its tendency to erode and destroy it closely imitates the latter disease. Lupus included ulceration, inflammation, and hypertrophies, variously combined—states which were not cancerous, not epitheliomatous, and not syphilitic. It may turn out that several diseases are included in this comprehensive term, but at present, on account of their apparent similarity, they are combined in one description. They are far from being so uncommon as is sometimes supposed.

Pelvic inflammation.—In endeavouring to trace the development of our knowledge of acute inflammations in the pelvis we may date our researches from the year 1840 or thereabouts. Before this time, though abscess of the womb had been mentioned by such early writers as Aetius and Paul of Ægina, yet no systematic study of the affection had been made. However, after the year 1840 many observers were at work. Thus in 1841 Bourdon had written on "Fluctuating Tumour of the True Pelvis"; Doherty in 1843 had given us his views on chronic inflammation of the uterine appendages; Calvi in 1844 had described "Intrapelvic Phlegmonous Abscess"; while in the same year Churchill and Lever had contributed to our knowledge of the subject. A little later, in 1846, Nonat was doing good work in the same field. Any one, however, who reads the medical history of these times will see clearly that the gynæcologists of those days were under the impression that all the pelvic exudations or abscess sacs were solely due to inflammation, or, may be, to suppuration, occurring in the cellular tissue of the true pelvis. Such terms as pelvic abscess, peri-uterine phlegmon, parametritis, and pelvic cellulitis, all meant practically the same thing, namely, connective tissue inflammation. The first advance in our knowledge came through Bernutz: in 1857 a case of so-called peri-uterine phlegmon came under his care, and the patient died. At the post-mortem examination the pelvic tumour which had been supposed to be formed by inflammation of the pelvic cellular tissue was found to consist of bladder, uterus, broad ligaments, and sigmoid flexure all matted together. The cellular tissue of the broad ligament and uterus was not involved, and no real peri-uterine phlegmon existed. The study of this and similar cases caused Bernutz and Goupil about the year 1862 to publish their classical memoir, in which abundant clinical and post-mortem evidence was brought forward to prove the true nature of the swellings previously ascribed solely to the effect of pelvic cellulitis. Bernutz summed up his views as follows :—

1. That inflammation of the pelvic peritoneum is a disease very commonly met with. 2. That the tumour found after death in cases of pelvic peritonitis is formed by the matting together of various pelvic viscera as a consequence of this inflammation. 3. That inflammation of the pelvic serous membrane is always symptomatic, and that it is generally symptomatic of inflammation of the ovaries or of the Fallopian tubes.

Old ideas, however, die hard; and though Bernutz had brought forward such abundant proof in support of his assertions, yet for many years his views met with little general acceptance by the majority of gynæcologists, and the old opinions continued to be taught and held. Even such a keen observer as the late Matthews Duncan thought that Bernutz had been over-zealous in estimating the comparative frequency of pelvic peritonitis and the rarity of pelvic cellulitis. For some years opinions were strongly divided upon the comparative frequency of cellulitis and peritonitis. With the narrowness and bitterness born of imperfect knowledge, some authors laid down strongly that in pelvic peritonitis, cellulitis exists only as a complication; while others were as ready to assert that cellulitis is in all instances the primary affection, and that the inflammation only spreads secondarily to the peritoneum. Writing in 1880, Gaillard Thomas, however, records his conclusions under four distinct propositions, namely :—

"1. Peri-uterine cellulitis is rare in the nonparous woman, while pelvic peritonitis is exceedingly common.

"2. A very large proportion of the cases now regarded as instances of cellulitis are really cases of pelvic peritonitis.

"3. The two affections are entirely distinct from each other, and should not be confounded simply because they often complicate each other; they may be compared to serous and parenchymatous inflammation of the lungs—pleurisy and pneumonia. Like them they are separate and distinct, like them they affect different kinds of structures, and like them they generally complicate each other.

4. "They may usually be differentiated from each other, and a neglect of the effort at such thorough diagnosis is as reprehensible as a similar want of care in determining between pericarditis and endocarditis."

Again, in 1886, Hart and Barbour stated that there was little doubt that Bernutz and Goupil pushed their views too far, and that in America, Germany, and Britain, gynæcologists considered pelvic inflammation as both peritonitic and cellulitic. Moreover, they note that both diseases are always combined. Thus in a marked pelvic peritonitis there is always some pelvic cellulitis, and in a marked pelvic cellulitis there is always some pelvic peritonitis. This is quite analogous to what is found in pneumonia and pleurisy. Thus we may fairly conclude from the result of modern investigations that inflammation both of the cellular tissue and also of the serous membrane may arise, but that of the two the latter is certainly the more frequent.

Much good work has been done of late years in developing our knowledge of the causation of pelvic cellulitis and peritonitis. In the case of the former disease recent investigations go far to show that the introduction of septic organisms into the lymph circulation, by way of rents after operation, abortions, or full-term deliveries, is most commonly the cause of the mischief.

As regards the production of pelvic peritonitis, the point of most interest is to consider how frequently the disease is consequent on a pre-existing salpingitis. In 1893 Dr. Cullingworth published his researches into this question. Under the heading of "Pelvic Inflammation usually a Peritonitis originating in Salpingitis," he says: "The usual state of things disclosed on opening the abdomen in these cases is as follows:—

"The contents of the pelvis are generally concealed from view by the great omentum, which has been drawn down so as to cover them anteriorly, and has contracted adhesions to the peritoneum as it becomes reflected on to the anterior abdominal wall, as well as to the uterus and other pelvic viscera. Along with this screen, as it were, of omentum, it is not unusual to find coils of adherent small intestine. On separating and drawing aside the screen, one side, or it may be the whole of the posterior part of the true pelvis, is seen to be occupied by what seems to be an indistinguishable mass of matted viscera. The uterus itself is sometimes implicated in the mass, but in other cases its upper part at least is free. Tracing the Fallopian tube outwards from the uterine cornu on the side of the disease, it is often found to be normal in size for the first half-inch or so, and then to become involved in the adherent mass. This mass, on being separated and brought into view, is invariably found to consist of the uterine appendages more or less altered by inflammation. There is always salpingitis, and the inflamed and thickened tube commonly enfolds the ovary, which is frequently normal."

A form of pelvic peritonitis has been described by Matthews Duncan and others under the name of "encysted serous perimetritis." The peculiar feature is that one or several collections of serous or sero-purulent fluids are found pent up among coils of intestines. The collection may occupy the pouch of Douglas, and press the floor of the pouch so forcibly downwards that the perineum bulges. In many cases of pelvic peritonitis small collections of serous fluid are found pent up by adhesions between the coils of intestines; but the disease is seldom specially described as serous perimetritis unless the amount of fluid pent up be very extensive.

With a more exact knowledge of the morbid anatomy and clinical history of these cases of pelvic inflammation, our treatment has undergone considerable modifications, and to a large extent active surgical interference has taken the place of a treatment purely medical and palliative. Indeed, as has been already pointed out, there has been a marked tendency to resort to the use of the knife in an undue percentage of cases; and often, too, in an early stage of the disease before time and observation have shown us what the natural powers of repair are capable of doing. The case is different when the presence of pus can be demonstrated with a fair amount of certainty; for, as an eminent surgeon has well said, a collection of pus calls for the same treatment, whether it occur in the mammary gland or in the pelvis, and opening of the abscess with evacuation of the pus is urgently demanded in either case.

Disorders of Menstruation.—The division of these disorders into three groups, namely, amenorrhœa, menorrhagia, and dysmenorrhœa, is a very old and a very excellent one. In the last fifty years our knowledge of menstruation and its variations has undergone considerable development, not only through the revelation of new facts, but yet more by the exclusion of much that was purely imaginary and false.

Study of the infantile uterus by Williams and others has shown that to speak of the layer of tissue superficial to the muscular fibres as the mucous membrane is not correct, for the human fœtal uterus shows a distinct submucous layer just beneath the peritoneum, so that nearly the whole of the muscular thickness of the human uterus belongs, morphologically, to the mucous membrane layer.

Modern research has made one point fairly certain, namely, that the whole of the mucous membrane of the uterus is not shed every month; but rather that certain changes in the nature of hypertrophic and fatty degeneration occur, which lead to the exfoliation of the superficial part of this membrane. The papers bearing on this subject by Kundrat and Engelmann, Leopold, Williams, Wyder, and others, are too well known to call for further comment.

Another interesting question, which has been discussed lately, and on which much light has been thrown, is that of the rhythmical contractions of the uterus which occur during menstruation. Viewing menstruation as a miniature labour, one would expect that rhythmical contractions, akin to the recurring pains of parturition, would be set up at the menstrual epoch; and some years ago Braxton Hicks stated his belief that these contractions do occur.

Menorrhagia.—Improved methods of dilatation, and the safety which comes from the use of antiseptics, have done much to enlighten us on the causation and treatment of uterine hæmorrhage. Thus twenty years ago comparatively nothing was known of the existence and frequency of morbid conditions of the endometrium; whereas the use of the curette and digital exploration of the uterine cavity have shown us its frequency in cases of endometritis and fibroid tumour.

Attention has been paid in late years to the influence of obstructions circulatory in the production of uterine hæmorrhage. Thus the late Dr. Wiltshire pointed out the effects of the early stages of hepatic cirrhosis, consequent upon the abuse of alcohol, in keeping up uterine blood loss. Again, in the case of an overloaded right heart, due to valvular or to pulmonary disease, another mode of production of menorrhagia has been shown; for by the use of means calculated to assist the heart's action the uterine disorder is materially relieved and often cured. In the knowledge, moreover, of such drugs as hamamelis and hydrastis canadensis, we have made valuable additions to our store of uterine hæmostatics.

Dysmenorrhœa.—It is a cause for regret that we have made so little advance in our knowledge of this common disorder; still, in some respects we may claim to have gained a more exact and scientific acquaintance with the phenomena of painful menstruation. Tyler Smith and other authors have compared the act of menstruation to a miniature pregnancy; and Handfield-Jones, following out this simile, has shown that in a large proportion of cases the pain of dysmenorrhœa is due to some morbid condition at the os internum, and that the pain really depends on dilatation of the internal os by uterine contractions under morbid conditions. I have said that uterine contractions are present during menstruation, and that their effect in dilating the cervical canal is capable of clinical proof.

In the short space available it has been impossible to trace at all adequately, or to do justice to, much which may be reckoned as development of our science and practice; but enough has been reviewed to show that in every department of gynæcology—in pathology, in bacteriology, in anatomy, clinical medicine, and surgery—well-marked progress has been made; and if at times advance has been retarded by over-zealous enthusiasts, still even to them we are perhaps indebted for the finger-posts which point out the roads on which we should not travel. It is clear that much of our increased knowledge is due to improved surgery, and to say this is again to declare the debt we owe to Lord Lister.

Mr. Pearce Gould put the matter very eloquently when, in his recent address on the Evolution of Surgery, he said: "Although science knows nothing of nationality, and we rejoice in additions to our knowledge, and to our powers of combating disease and death, whether it comes to us from a French Pasteur, from a Teuton Koch, from our Western cousins on the other side of the broad Atlantic, or from a son of that Eastern Empire now rising above the horizon, we cannot help feeling a special pride in the fact that the name that shines with an unrivalled splendour on the page of surgical history is that of the Englishman Joseph Lister."

MONTAGU HANDFIELD-JONES.

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M. H.-J.

THE ANATOMY OF THE FEMALE PELVIC ORGANS

A description of the anatomy of the genital organs, for gynæcological purposes, should have its own topographical basis; that is, it should be described in relation to the bony pelvis.

I shall therefore arrange this subject under the following heads :—

I. *The main points in the anatomy of the adult female bony pelvis and of the pelvic floor filling in the pelvic outlet.*

II. *The anatomy of part of the outer aspect of the floor—that is, of the vulva or external genitals.*

III. *The anatomy of the organs and tissues in the substance of the pelvic floor—that is, of the vagina, urethra, and bladder; rectum and anus; connective tissue, blood-vessels, lymphatics and nerves.*

IV. *The anatomy of the organs on the upper aspect of the pelvic floor—that is, of the uterus, Fallopian tubes, broad ligaments and ovaries; the pelvic peritoneum.*

V. *The position of the organs; their dissection and structural anatomy.*

VI. *The surgical anatomy.*

VII. *The development of the organs.*

This convenient method of considering our subject is open to some objections. It might be argued, for instance, that the anus and urethra could be considered in other divisions than those in which I have placed them. The present arrangement, however, will be found suitable for our purpose.

I. The main points in the anatomy of the Female Bony Pelvis and of the Pelvic Floor filling in the outlet.—The brim of the pelvis (Fig. 1) has, as its boundaries, from left to right, the promontory, left sacro-iliac joint, left ilio-pectineal eminence, symphysis pubis, right ilio-pectineal eminence, right sacro-iliac joint, and thus back to the promontory.

The part of the pelvis above the brim is termed the "false" pelvis; that below the brim is spoken of as the "true" pelvis. It is in the true pelvis and in relation to the outlet that the unimpregnated female genital organs are placed.

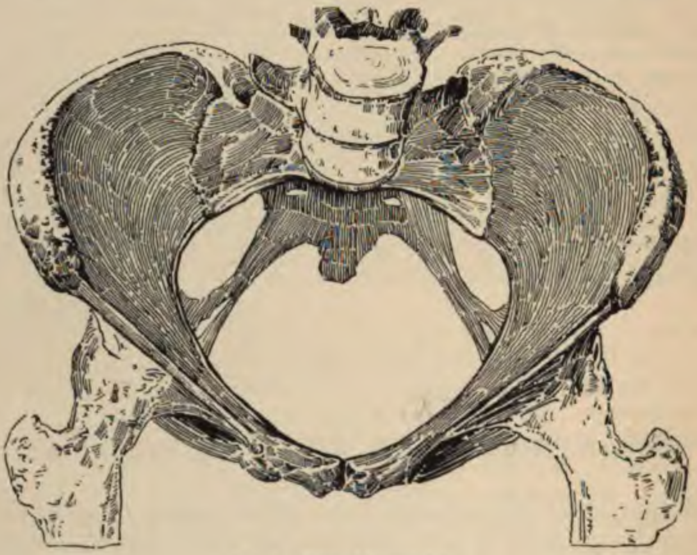

FIG. 1.—Brim of bony pelvis.

If the bony pelvis be regarded in sagittal mesial section (Fig. 2), we can see the conjugate; the cavity of the true pelvis, with its inlet, cavity and outlet; the inclination of the conjugate to the horizon (average of 60°), as well as the outline of the pelvic floor. What of the pelvic floor projects beyond the outlet-conjugate is termed the pelvic floor projection, and averages, at its utmost, about 3·2 cm.

On the outer aspect of the pelvic floor lie the external genitals, and these in the upright posture have a direction nearly parallel to the horizon.

In the substance of the pelvic floor lie the vagina and urethra, parallel to the conjugate, and about 2½ to 3 inches below its level; the anus with its long axis at right angles to these; and resting on the upper surface, the peritoneum and the uterus with its appendages (Fig. 3). Dr. Herman gives the following table of clinical measurements:—

Projection of pelvic floor	3·2 cm.
Coccyx to anus	4·5 cm.
Fourchette to pubic arch (nulliparæ)	2·19 cm.

II. The anatomy of the External Genitals—that is, of part of the outer aspect of the pelvic floor.—The external genitals lie on a surface extending from the front of the symphysis pubis downwards and backwards between the thighs, their posterior boundary, the fourchette, being about 1-1½ inch in front of the anus. They comprise the following structures; namely, the labia majora, labia minora, fourchette, clitoris and prepuce, vestibule, urethral orifice, hymen, fossa navicularis.

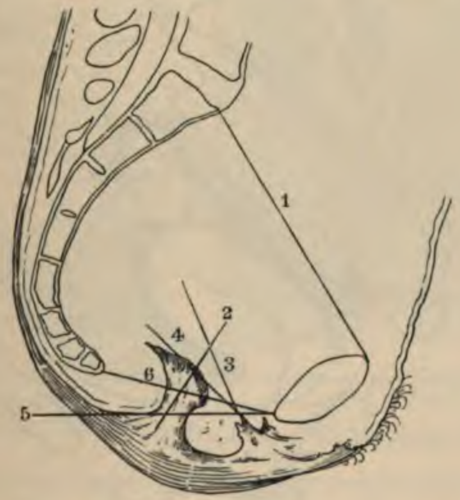

FIG. 2.—Diagram of bony pelvis and of pelvic floor. 1, Conjugate; 2, anal axis; 3, 4, vaginal and urethral axes; 5, horizontal line; 6, outlet-conjugate.

The general arrangement of these parts is see in Figs. 2 and 4.

It must be noted that in order to see these parts in the living woman their mutual relations are necessarily disturbed. It is therefore of importance to note that, in the undisturbed condition, the labia majora and minora, being in contact by their inner surfaces, conceal the deeper structures, the minora only projecting slightly beyond the majora; that probably the lateral halves of the vestibule are in apposition; that the lateral edges of the fourchette touch, forming a long U, as seen in Fig. 4; and that the lateral edges of the hymen are also in contact.

The *labia majora* are two folds of skin, united above over the pubes in the mons veneris, which pass downwards and backwards between the thighs, gradually thinning off at a point 1½ inch in front of the anus. Short crisp hair covers their outer aspect, and microscopically we find sweat glands, hair follicles, and the usual constituents of a skin structure.

The *labia minora* are also formed of skin of a thin, fine quality; they lie obliquely on the inner aspect of the upper two-thirds of the labia majora, and by the bifurcation of their upper ends form the prepuce of the clitoris and its so-called suspensory ligament.

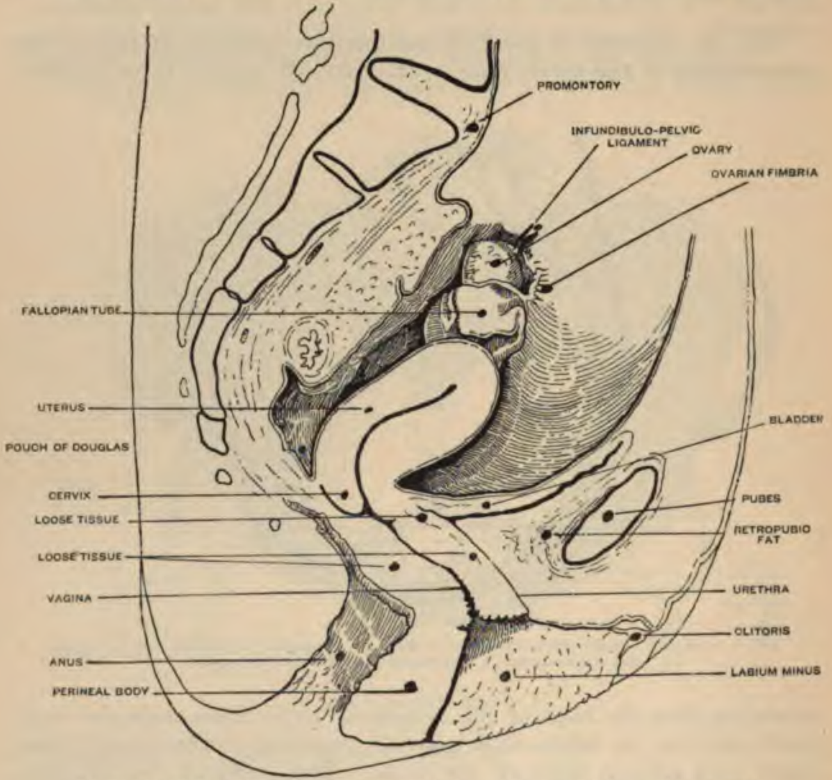

FIG. 3.—Sagittal mesial section of female pelvic floor. The ovary is larger than normal, and the tube relations not quite normal.

The *vestibule* is a triangular surface of smooth mucous membrane covered with several layers of epithelium, lying between the labia minora, and having the hymen at its base; the urethral orifice is in the middle of the base line immediately above the hymen. In the middle line, in the virgin, is a grooved ridge which represents the corpus spongiosum of the male—Pozzi's male vestibular band.

The posterior ends of the labia minora form a narrow U-shaped loop

—the *fourchette*: if these margins be separated we see the fossa navicularis as a shallow fossa, artificially made by the examination, and bounded by the inner aspects of the fourchette and outer and lower portions of the hymen. Between the fourchette and base of the vestibule lies the *hymen*, the anatomical entrance to the vagina. It consists of a thin fold of mucous membrane, perforated, so that when viewed undisturbed, its opening forms a vertical slit with its edges in contact. According to Dr. Cullingworth, the hymen is a longitudinal fold of mucous membrane with its edge directed forwards, and divided along about three-fourths of its length by a slit which extends nearer its upper than its lower extremity. The alterations in it induced by coitus and labour belong to obstetrics.

The *anal* opening lies about 1½ inch posterior to the fourchette, and between the two is the skin over the base of the perineal body (Fig. 4).

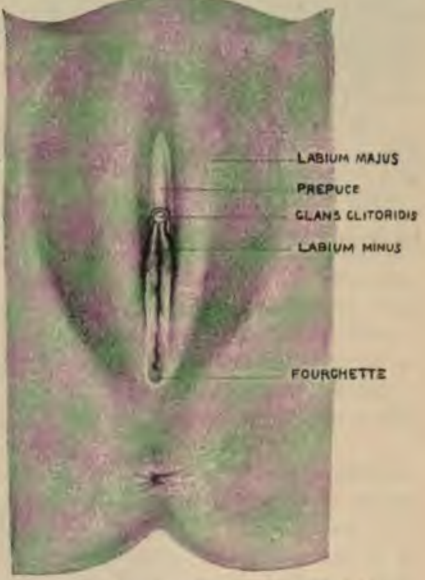

Fig. 4.—Virgin external genitals with the labia majora separated.

The glans of the clitoris covered by its prepuce lies at the apex of the vestibule.

III. The anatomy of the organs and tissues in the substance of the pelvic floor—that is, of the Vagina, Urethra, Bladder, Rectum, and Anus, Connective Tissue, Blood-Vessels, Lymphatics, and Nerves. —The *vagina* is a transverse slit in the pelvic floor, extending from the hymen to the fornices, where it passes on to the outer aspect of the vaginal portion of the cervix uteri at the base of the latter; the demarcation between them being recognisable to the naked eye.

The vagina lies parallel to the conjugate, and consists of two apposed walls, anterior and posterior. Each wall is broader above than below, and is therefore somewhat triangular in shape. The mucous membrane lining it is thrown into many transverse shallow folds—the rugæ of the vagina. At the lower end of the posterior wall is one short vertical fold, the posterior column of the vagina; while there are usually two at the corresponding portion of the anterior wall—the anterior columns of the vagina. They are said to represent the remains of the septa between the two ducts of Müller, from part of which the vagina is formed (Fig. 3).

Between the vaginal portions of the cervix and the reflexions of the vaginal walls lie the fornices of the vagina—anterior, lateral, and posterior. The anterior is the guide to the loose tissue between the bladder and the cervix; the lateral lie at the inner aspects of the bases of the broad ligaments, and form a guide to the uterine artery and ureter; while the posterior is separated from the peritoneum of the pouch of Douglas by about ⅓ inch of tissue. The walls of the fornices are in contact.

On sagittal mesial section (Fig. 3) the anterior wall, 2½ inches long, is seen to be straight; the posterior wall, 3½ inches long, bends forward at its upper part.

On transverse section the vagina is crescentic at its upper part, H-shaped lower down, and vertical at the hymen.

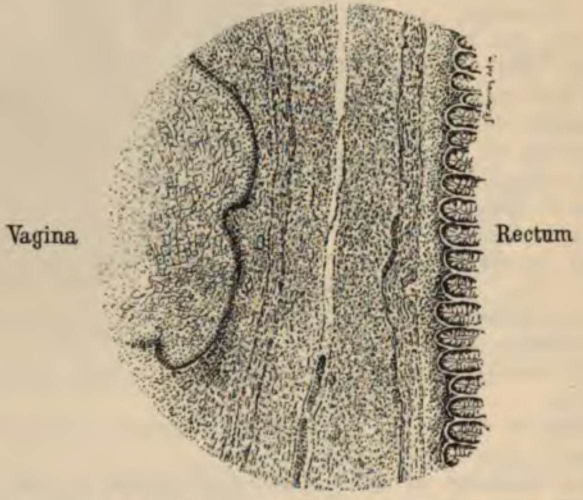

FIG. 5.—Rectal and vaginal mucous membrane.

Microscopically the hymen has multiple epithelium on its outer and inner aspects, the latter being thicker.

The vagina is lined on its free surface by many layers of squamous epithelium; deeper down near the papillæ the epithelium is more oval in shape. This epithelium lies on papillæ of connective tissue, with elastic tissue and unstriped muscular fibre. Outside this lie two layers of unstriped muscular fibre, an outer (circular) and inner (longitudinal). Only a few glands are present in the vagina, which has a structure quite analogous to skin.

It is of great importance to note that loose connective tissue separates the anterior rectal wall and the posterior vaginal wall, and lies also between the bladder wall and the anterior vaginal wall. The urethra and anterior vaginal wall are closely incorporated.

The *urethra* forms a slit in the pelvic floor, parallel to the vagina, and is in reality a tonically contracted sphincter 1⅜ inch long with the urethral orifice below and the bladder-opening above. It is lined with many layers of epithelium, squamous below, and like that of the bladder above. It is well provided with elastic tissue and muscle; for there are not only circular and longitudinal unstriped fibres, but the same arrangement of striped muscle also. Finally, we should keep in mind that at the meatus mucous glands are present as well as villous tufts. Skene's tubules lie at the lower end of the floor of the urethra, are two in number, about ¾ in. in length. A very important practical point about the urethra is its dilatability. By means of suitable dilators an amount of dilatation can be obtained sufficient to admit the ordinary index finger. Over-dilatation, however, may cause incontinence.

With the empty bladder the urethra forms a Y on sagittal mesial section (Fig. 3), the anterior limb of the Y being the longer. Between the urethra, anterior surface of bladder, and the posterior aspect of the pubes is a space triangular on section, containing loose tissue and fat—the retro-pubic fat (Fig. 3). The *bladder* is seen in the cadaver as a thick-walled, apparently contracted organ, with its anterior and posterior walls in contact. On sagittal mesial section the cavity then forms a slit continuous with the urethra.

The bladder walls consist of mucous membrane lined with multiple and multiform layers of epithelium, and of unstriped muscle in three layers; its fundus alone is covered by peritoneum. The mucous and muscular coats are separated by loose tissue. The empty bladder is a pelvic organ in the non-pregnant woman. It is generally believed that its capacity is greater in women than in men; and, as a matter of fact, many women pass water twice only in the twenty-four hours.

The *ureters*, two in number, run between the kidneys and the bladder. I shall describe their course in the pelvis only. At the pelvic brim each crosses the external iliac artery, and passes down the side wall of the pelvis below the level of the fossa ovarii. Where the vesical and obturator vessels originate, it begins to describe a bow-shaped curve, the middle portion of which is crossed by the uterine artery at the level of the os uteri externum, from which it is about ⅜ inch distant. It here lies related to the side of the vagina (Figs. 8 and 19), and then runs between the anterior vaginal wall and posterior bladder wall. It finally runs in the substance of the bladder wall for about 0·6 inch, and opens into the bladder cavity.

If the bladder cavity be laid open we shall see three openings into it; namely, the internal orifice of the urethra in the middle, and a ureteric opening at each side. The latter are about 1½ inch from the middle line. Between the ureteric ends lies the inter-ureteric ligament.

The *rectum* begins at the pelvic brim and ends at the anus. We recognise three portions; namely, the first part, provided with a meso-rectum, beginning at the left sacro-iliac joint, and ending at the third sacral vertebra; the second part, where the peritoneum gradually passes off from behind towards the front; and the third part lying behind the posterior vaginal wall. It is separated from the posterior vaginal wall by loose tissue. The microscopical structure of the rectum is peritoneum outside; unstriped muscular fibre in two layers—the longitudinal inner, and the circular outer; and a submucous coat with a mucous membrane provided with a muscularis mucosæ. The mucous membrane is provided with abundant Lieberkuhnian follicles.

There are two important crescentic folds in the rectum which form the sphincter tertius; they lie, one on the anterior wall, the other on the posterior. Each is about 1½ inch from the anus, the posterior being the higher. The fold is formed by a special thickening of the circular muscles.

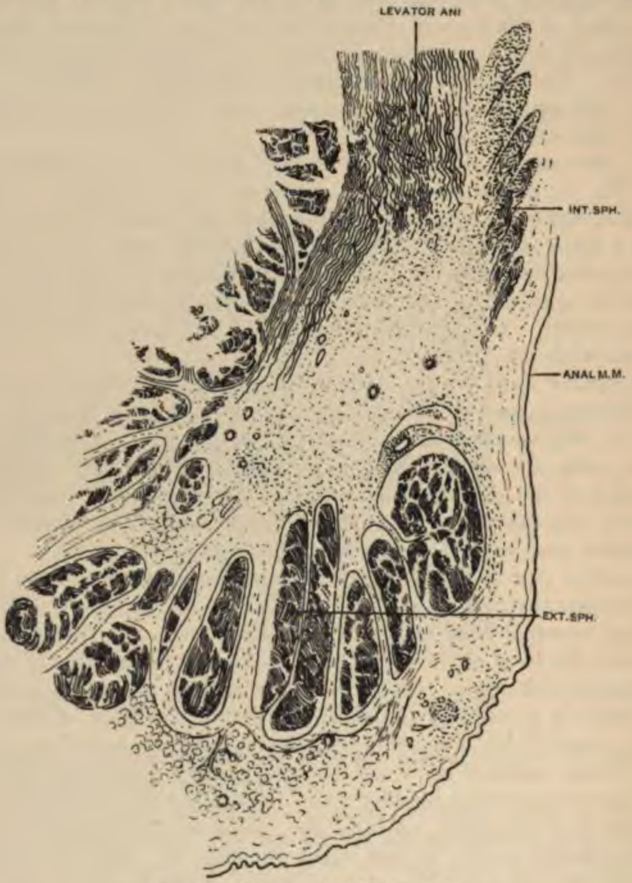

FIG. 6.—Sphincter ani in full-time fœtus.

The *anus* is a closed slit in the pelvic floor with only a slight anteroposterior linear measurement. It measures about an inch in length, and runs parallel to the axis of the pelvic brim; that is, at right angles to the rectal, vaginal, and urethral axes (Fig. 2). It is provided with a strong musculature (Fig. 6); namely, the sphincter externus and sphincter internus,—the latter in two layers, circular (outer) and longitudinal (Ruedinger).

In front of the anus lies the *perineal body*, its apex being about the level of the internal opening of the anus and external orifice of the urethra. It is a pyramid of elastic tissue and of striped and unstriped muscular fibre. It forms a bracing point, therefore, for much of the musculature of the pelvic floor; namely, for sphincter ani, transversus perinei, bulbo-cavernosus, and levator ani (Figs. 3, 7, 8, and 9).

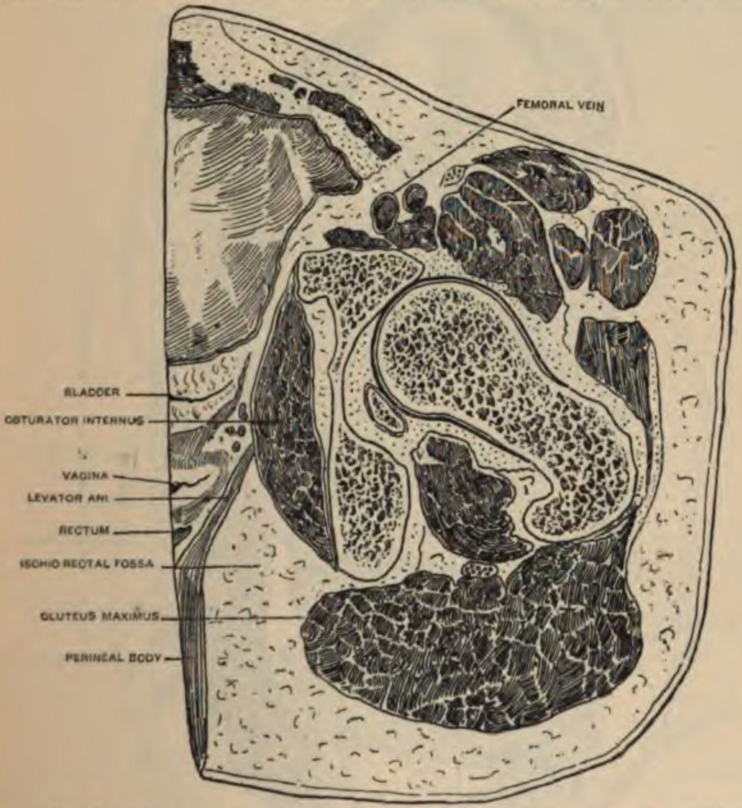

FIG. 7.—Axial transverse section of right half of female pelvic floor. (Seen from behind.)

The *connective tissue* of the female pelvis is very abundant and of great importance. It packs all the interstices between the main organs, and is of great pathological interest, as in it run the lymphatics, blood-vessels, and nerves. Although the pelvic connective tissue is practically continuous, and passes up into the iliac fossæ and abdominal cavity, it is convenient to recognise it as being present in the following situations:—

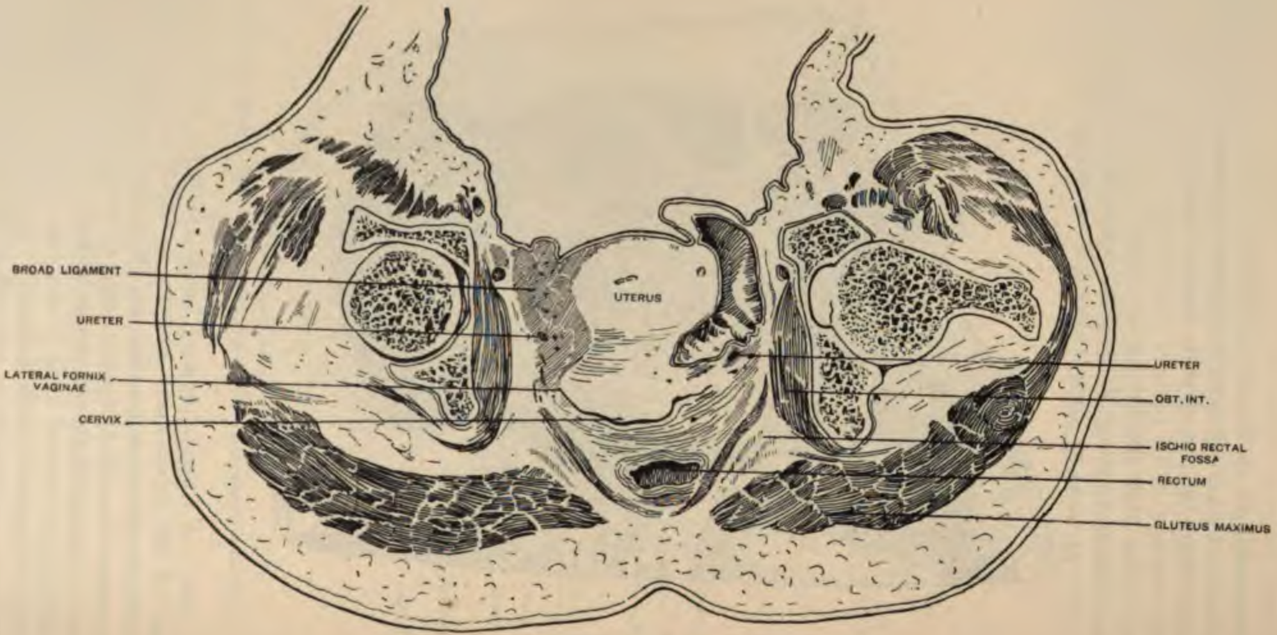

FIG. 8.—Axial transverse section of female pelvic floor.

(*a*) Round the cervix uteri: this is the parametric tissue proper of Virchow. (*b*) Between the broad ligaments. (*c*) Between the posterior bladder wall and cervix uteri. (*d*) Between the vagina and the anterior rectal wall. (*e*) Between the bladder and the pubes. (*f*) In the ischio-rectal fossa and below the peritoneum.

By some anatomists the term parametric tissue is made equivalent to pelvic connective tissue.

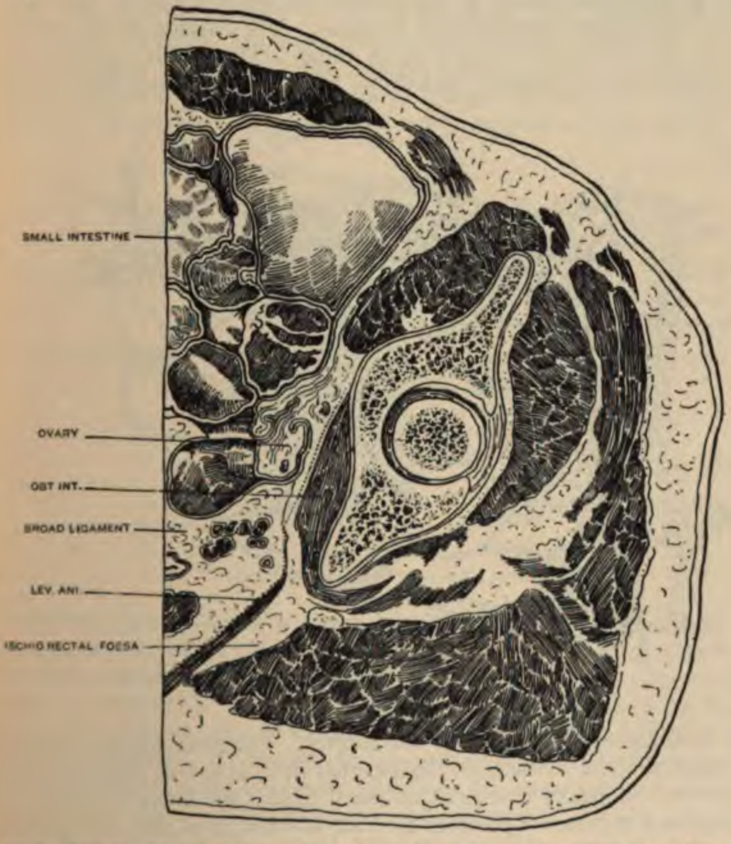

FIG. 9.—Axial coronal section of right half of female pelvis. (Seen from behind: dotted line = fascia.)

We have also in the pelvic floor an arrangement of sheet fascia—the pelvic fascia of the anatomist; the main parts of which can be seen in the diagrams of frozen sections (Figs. 7, 8, and 9).

The arterial supply of the pelvis is derived from the *ovarian* and *uterine arteries.*

The *ovarian artery* is a branch of the aorta, and passes along the upper border of the broad ligament below the level of the Fallopian tube. It gives branches to the tube, ovary, and round ligament; and then at the junction of tube and uterus passes tortuously down the sides of the uterus to join the uterine artery. From the arch thus formed at the side of the uterus branches pass at right angles into the uterine substance.

The *uterine artery* is a branch of the anterior division of the internal iliac. It passes downwards and inwards towards the cervix uteri, giving a well-marked branch to the cervix—the circular artery; but sometimes several smaller branches take its place. The relation of the uterine artery to the ureter must be kept in mind. The uterine artery also gives branches to the vagina; and these, with branches from the circular artery, form the azygos artery of the vagina. The *pudic artery*, a branch of the same anterior division of the internal iliac, is a well-marked vessel at the outer boundary of the ischio-rectal fossa; and from it we get the superficial and transverse perineal arteries, the artery to the bulb, corpus spongiosum, and clitoris, and the inferior hæmorrhoidal artery (Figs. 10 and 21).

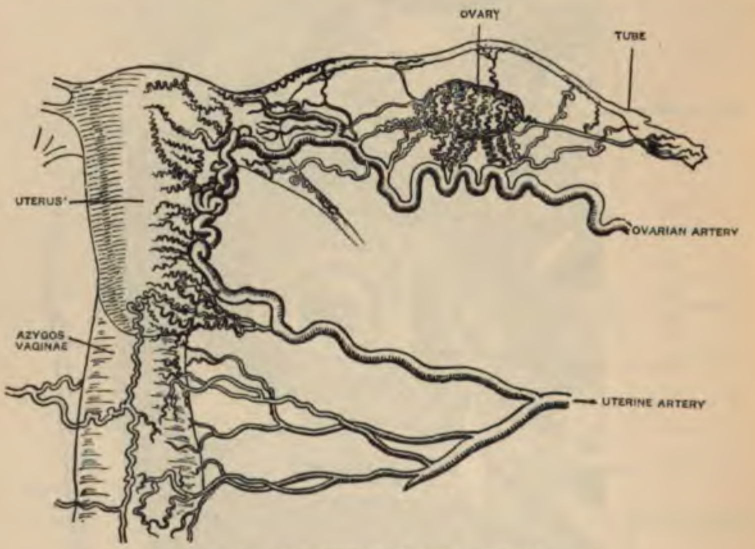

Fig. 10.—Blood-supply of uterus. (Hyrtl.)

The *venous supply* of the pelvis consists of many anastomosing plexuses. There are thus vesical, hæmorrhoidal, labial, vaginal, uterine, ovarian, and pampiniform plexuses. The vesical, vaginal, hæmorrhoidal, and pudic veins open into the internal iliac, and this passes to the inferior vena cava. An important point is that the superior hæmorrhoidal vein passes to the portal system, and we thus get an anatomical explanation of the menorrhagia of drunken women. The pelvic veins are unprovided with valves.

The uterine plexus opens into the ovarian veins; the right ovarian vein passing to the inferior vena cava, where it is provided with a valve; the left to the renal vein.

The *lymphatics* (Figs. 11 and 12) of the pelvis begin in connective tissue spaces, form plexuses, and are so arranged that those from definite areas pour into definite groups of glands. Thus the lymphatics of the external genitals and lower fourth of the vagina pour into the oblique inguinal glands; those of the upper three-fourths of the vagina and cervix uteri into the iliac glands. The lymphatics of the body of the uterus pass along the broad ligaments, and, accompanied by those from the ovary and Fallopian tube, reach the lumbar glands. The lymphatics of the round ligaments open into the inguinal glands, and a gland lying on the obturator membrane also establishes a communication between the pelvic connective tissue and the inguinal glands. The rectal lymphatics open into the sacral glands; those of the bladder pass to the iliac glands.

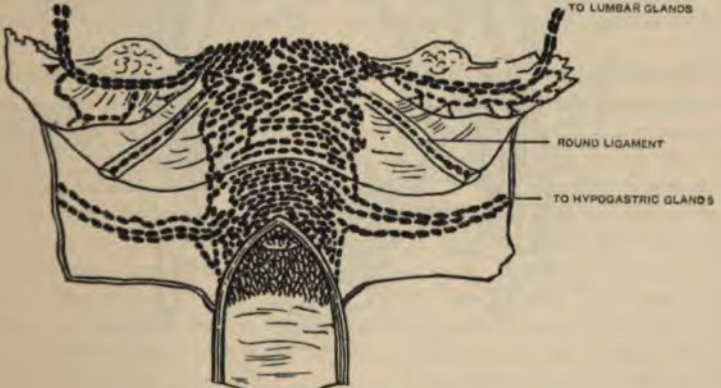

FIG. 11.—Lymphatics of uterus. (Poirier.)

These facts are of great pathological importance. In malignant disease of the vulva and lower fourth of the vagina, the oblique inguinal glands are affected; but in cancer higher up, the pelvic and lumbar glands are first infiltrated. Through the lymphatics of the round ligament, and especially through the obturator gland, we may have, though rarely, late infection of the inguinal glands in uterine cancer. I have now several times seen the inguinal glands enlarged in pelvic sarcoma, and in one instance I found the obturator gland distinctly enlarged.

The abundant lymphatic supply of the pelvis explains the inflammatory attacks arising from sepsis and gonorrhœa, and abundant evidence of their importance will come up afterwards. Here we can only emphasise the great importance of antiseptics in operative work, and the avoidance of all minor manipulations with the sound as a means of diagnosis in the consulting-room.

The *nerves* of the pelvis are spinal and sympathetic. The levator and sphincter are innervated by the inferior hæmorrhoidal branch of the

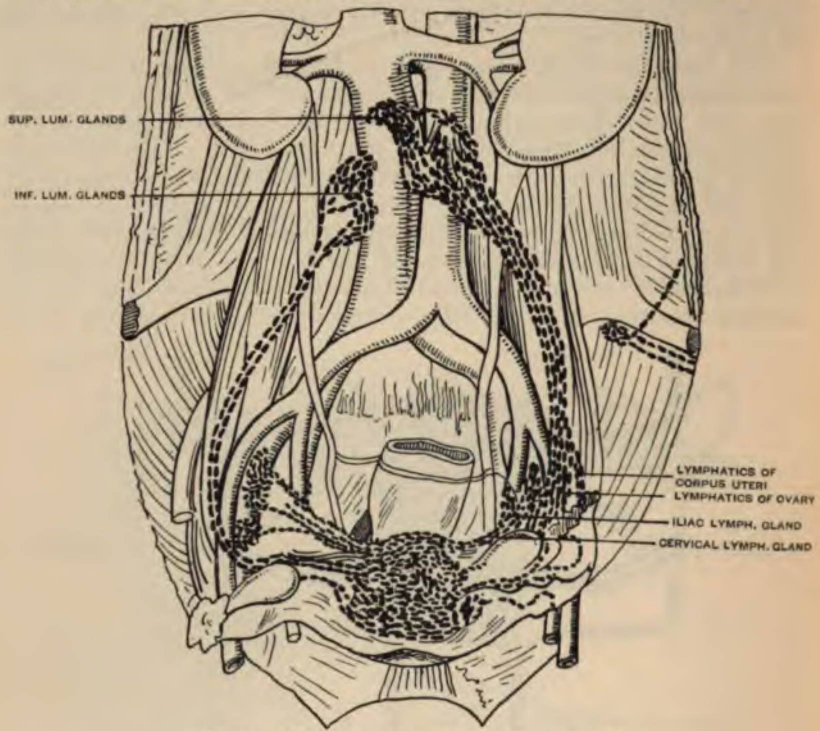

Fig. 12.—Lymphatics of uterus and pelvis. (Poirier.)

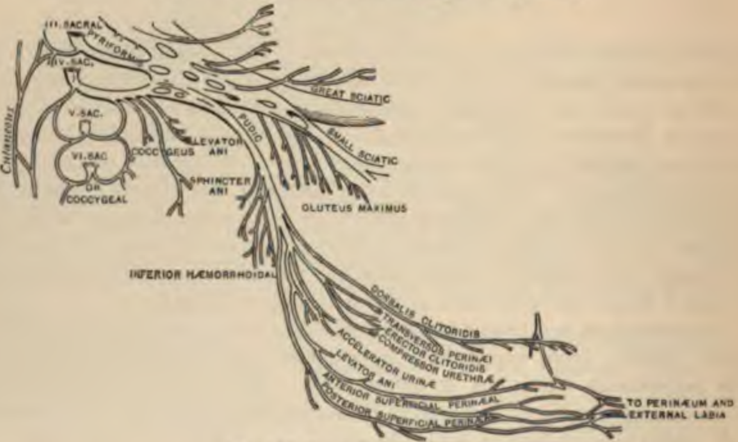

Fig. 13.—Nerve diagram. (Flower.)

pudic, and by the fourth and fifth sacral and coccygeal nerves; the coccygeal nerves and fourth and fifth sacral also supply the coccygeus. Branches of the pudic nerve pass to the muscles of the perineum and clitoris.

The sympathetic is arranged in many plexuses. The hypogastric plexus between the common iliac arteries gives branches which, with those from the lumbar and sacral ganglia and sacral nerves, make up the inferior hypogastric plexuses lying on each side of the vagina. Branches from them pass to the vagina, uterus, Fallopian tubes, and ovaries.

Special end bulbs are found in the clitoris and labia minora. In the vagina the nerves end in the epithelium. In the uterus, nerve plexuses and nerve cells are present in the muscular coat, and the nerve-endings can be traced to the glands and epithelium.

In the tube the nerves are arranged in two concentric plexuses, ending in the epithelium and in the nerve cells of the submucosa. In the ovary the nerve-endings have been traced to the Graafian follicles and cells of the membrana granulosa.

Pain is so common a gynæcological symptom that it is remarkable that gynæcologists have not brought more precision into their descriptions of it. In a paper in *Brain*, Dr. Head has attempted to give greater accuracy to the definition of these sympathetic painful areas; he states that the area for ovarian pain is "limited above by a line running horizontally from the top of the first lumbar spine to the umbilicus; below by a line running from the third lumbar spine to midway between the pubes and umbilicus, but having a little downward tag near the anterior superior iliac spine." For the body of the uterus and Fallopian tubes the area is bounded above by the preceding one; and below by a line running from a little below the top of the sacrum to the symphysis, but having a dip down over the buttock, and another over the front of the thigh. For the cervix uteri the painful area is over the lower part of the sacrum. For the ovary, therefore, it is formed by the sensory fibres from the tenth dorsal nerve root; for the body of the uterus and Fallopian tubes by the sensory fibres of the eleventh and twelfth dorsal nerve roots; and for the cervix by the sensory fibres of the third and fourth sacral roots.

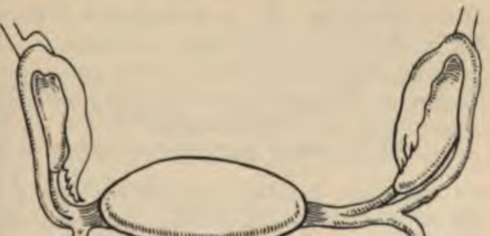

Fig. 14.—Relations of uterus and ovaries viewed through brim. (His.)

IV. The anatomy of the organs on the upper aspect of the pelvic floor—that is, of the Uterus, Fallopian Tubes, Broad Ligaments and Ovaries; the Pelvic Peritoneum. (Figs. 14 and 15.) *The Uterus.*—If the uterus be separated from its appendages, it will appear as a pear-shaped body with a constriction—the isthmus—slightly below its middle, dividing it into two great parts, the body and cervix. At its inferior extremity is the os uteri externum; at the upper right and left angles lie the openings of the Fallopian tubes. Its anterior surface is more flat than the posterior, and only the upper half of the former is covered by the peritoneum. If a vertical mesial section be made,

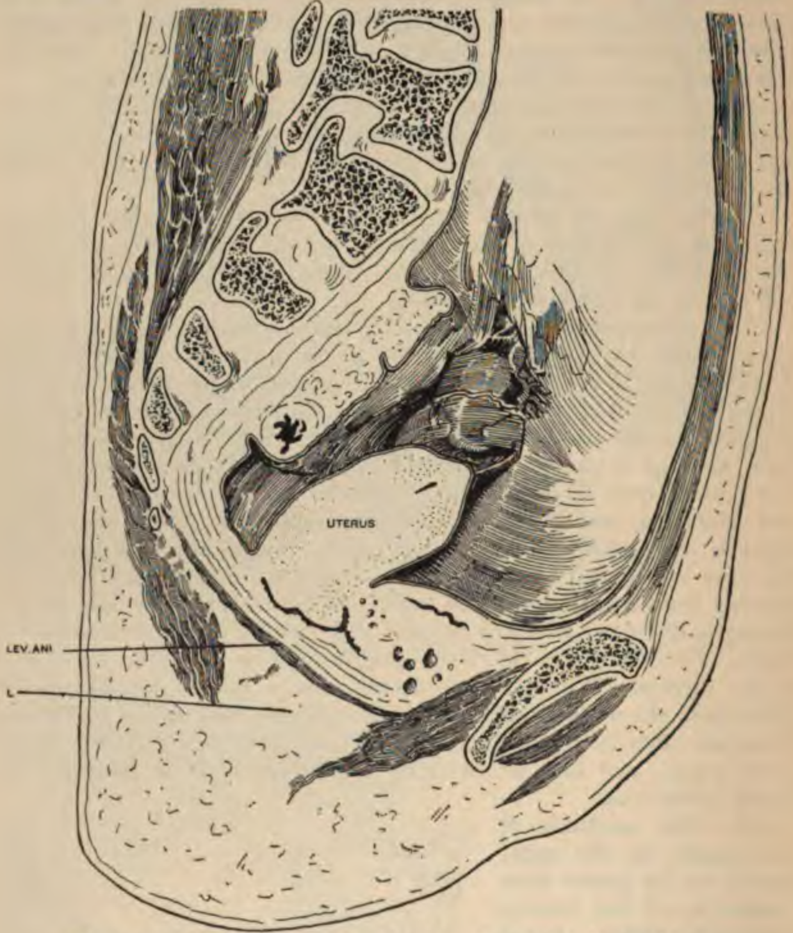

FIG. 15.—Sagittal lateral section of female pelvis. L points to ischio-rectal fossa.

we can then see that the uterus has a cavity or slit, that its walls are about half an inch thick, and that the cavity is lined by mucous membrane $\frac{1}{25}$ inch (1 mm.) thick. In a section through the cavity, dividing the uterus into anterior and posterior portions, we can see the shape and relations of its cavity more clearly displayed. The cervical canal is somewhat spindle-shaped, and the so-called uterine cavity consists of anterior and posterior triangular surfaces which normally, and in the unimpregnated condition, are in apposition. The os uteri externum is the lower boundary of the cervical canal; the upper boundary is less definite, but for practical purposes we may place it opposite the isthmus. The os uteri internum is the lower opening of the uterine cavity proper, while to the right and left above are the internal openings of the Fallopian tubes. These three points—namely, the os uteri internum and the Fallopian tube openings—map out the normal surface from which menstruation takes place, and where normal pregnancy occurs. It is difficult to divide the unimpregnated uterus accurately into its various parts. If we take the anterior wall of the uterus we may consider it as made up of three portions: firstly, the cervix, where the bladder is attached, and with the os uteri internum as its upper boundary—the average measurement of this is an inch; secondly, the lower uterine segment, which is rudimentary, and is bounded below by the os uteri internum, and above by the firm attachment of the peritoneum—it measures about half an inch, and has not yet been accurately mapped out; thirdly, the body of the uterus proper, which begins where the peritoneum is firmly attached, and extends up to the fundus.

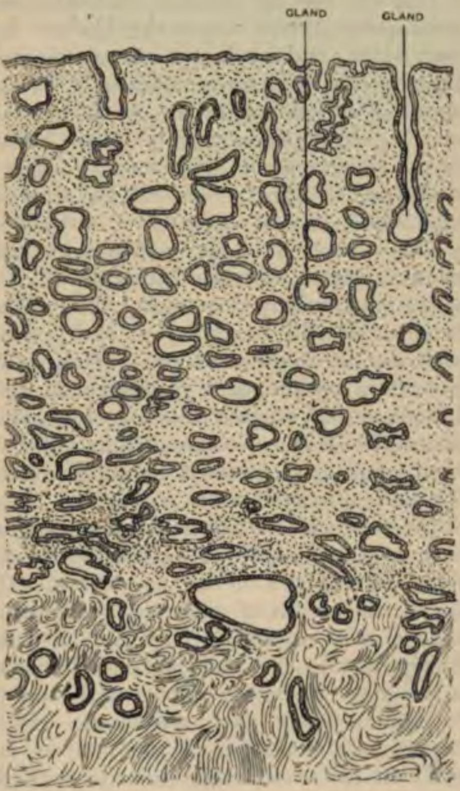

FIG. 16.—Uterine mucous membrane showing relation of glands and stroma.

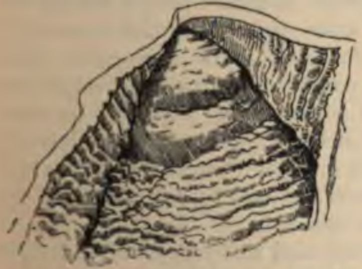

FIG. 17.—Cervix and upper part of vagina showing rugæ.

The cervix has been divided by some into a vaginal, middle, and supravaginal portion; and this division is of importance in relation to cervical hypertrophies. The vaginal portion is the symmetrical, unattached part of the cervix (Fig. 17); the middle portion is attached to the bladder in front, but is free behind; and the supravaginal portion is attached to the bladder in front and to the vagina behind.

Structure of the Uterus.—The outer aspect of the uterus is covered by peritoneum, except where the bladder is attached. Its wall is half an inch thick, and made up of unstriped muscular fibre and connective tissue. The mucous membrane of the uterus is important and merits special description. In the cervical canal the mucous membrane has a peculiar arrangement visible to the naked eye—the well-known *arbor vitæ.* This consists of a vertical ridge with lateral ones slanting upwards and outwards. The cervical mucous membrane consists of columnar epithelium, ciliated and narrow, with the nucleus deep in the cell. Many glands of a racemose type are present, and penetrate deeply into the connective tissue. In the substance of the cervix are dense connective tissue and unstriped muscular fibre. The vaginal portion of the cervix is covered with many layers of squamous epithelium continuous with and similar to that of the vagina. The mucous membrane of the uterine cavity proper is $\frac{1}{25}$ of an inch thick, and of a greyish red colour: it consists of a surface covering of columnar epithelium and an embryonic connective tissue. Numerous so-called "glands" open on its surface, and ramify and intersect in all directions down to the muscular coat. There is no submucous connective tissue. The "glands" are lined with columnar epithelium of the same nature as the surface epithelium, and continuous with it. So far as my observation goes, the epithelium does not rest on a membrana propria. There has been much discussion as to the nature of these so-called glands; it is best on the whole to regard them not as specially glandular, but as mere pits of epithelium, honeycombing the mucous membrane. The mucous membrane is really a lymphatic tissue, reticulated with epithelial diverticula whose function in some points we understand. During menstruation there is a superficial denudation of the mucous membrane; and it is from the epithelial pits and the connective tissue between them that regeneration takes place. During pregnancy also, we have, persisting in the maternal part of the placenta, close to the muscular coat, the fundi of these pits in the form of the well-known spongy layer. This arrangement permits not only of the separation of the placenta and membranes during the third stage of labour, but also gives again epithelium and connective tissue for the development of a new mucous membrane during the puerperium. The connective tissue itself consists of elongated cells with nuclei, and branching small round cells anastomosing with one another. Leucocytes when present are to be considered pathological; and the same is the case in regard to unstriped muscle in the stroma. According to Leopold, the bundles of connective tissue are surrounded by endothelial cells, which thus form lymph spaces.

The *Fallopian tubes* are two in number, and pass out from the right and left upper angles of the uterus towards the side of the pelvis in a way to be described more fully afterwards. Each is about 10 cm. in length, and lies below the upper margin of the broad ligament. They are covered by the peritoneum for about five-sixths of their periphery, the remaining and lower sixth resting on the connective tissue between the layers of the broad ligaments. The following divisions are recognised: a portion piercing the wall of the uterus, the interstitial part; a straight portion, or isthmus; a curved portion, the ampulla; and, finally, the fimbriated end, with the special ovarian fimbria. The tube consists of a peritoneal covering; a muscular coat in two layers, circular inner and longitudinal outer; and a remarkably folded mucous membrane. The mucous membrane lining the tube is continuous with that of the uterus, and is thrown into many longitudinal folds which pass out into the fimbriated end. In the fimbriated end can be seen the *ostium abdominale* or outer opening of the tube. One special fimbria, the ovarian fimbria, joins the ovary to the tube. We must note here the remarkable fact that the genital tract of woman communicates by this ostium directly with the peritoneal cavity (Figs. 14 and 15).

The mucous membrane of the Fallopian tube consists of columnar epithelium and connective tissue. The foldings of the mucous membrane are very much less marked in the isthmus, much more so in the ampulla. The question whether these foldings constitute glands is still disputed; but I see no valid reason as yet for considering them as anything more than a honeycomb arrangement of the tubal lining, indicating, so far as we know at present, its close developmental relation to the uterus. The calibre of the isthmus is such as to admit a bristle, while the ampulla will admit the ordinary uterine sound.

The tube in the fœtus has windings in it of a pathological interest. The *hydatid of Morgagni*, derived from the duct of Müller, is attached to the fimbriæ or tube, and has a mucous columnar lining with clear fluid. Muscle and peritoneum make up its head and stalk. It must not be confounded with cysts in the mesosalpinx arising from Wolffian relics.

Ovaries.—The ovaries, two in number, lie projecting from the posterior lamina of the broad ligament and on the side walls of the pelvis. The diameter of each ovary is $1\frac{1}{3}$ inch by $\frac{3}{4}$ by $\frac{3}{8}$ of an inch. The posterior surface looks backwards, the anterior is attached to the broad ligament; their long axis may be perpendicular or somewhat transverse. The part of the ovary joining the broad ligament is named the hilum.

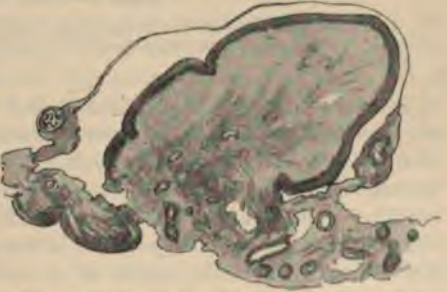

FIG. 18.—Seal's ovary showing cortical and medullary layers, also peritoneal capsule with tube on section.

Structure of the Ovary.—The ovary is covered on its outer aspect by columnar epithelium, the germ epithelium of Waldeyer, who first indicated its nature and importance in development. At the hilum the germ epithelium is continuous with the squamous epithelium of the peritoneum, the boundary being marked by the well-known white line of Farre. In fresh specimens the ovary has a dull, pearly lustre, the broad ligaments being more greyish. While Farre drew attention to this line of demarcation, he unfortunately omitted to note the real nature of the covering of the ovary, a mistake readily made if he examined adult ovaries only.

Below the germ epithelium lies the tunica albuginea, a condensed concentric arrangement of connective tissue. On section we see that the rest of the ovary is made up of two portions, a cortical or outer zone, and a medullary or vascular zone continuous with the tissue of the broad ligament. In the cortical portion, and surrounded by connective tissue, we have the remarkable structures known as the Graafian follicles. Each ovary contains a very large number of these follicles; but that they amount to eighty or ninety thousand, as some authors allege, is not quite certain. The Graafian follicles near the surface of the ovary are small, the deeper ones being larger; but a few of the largest lie at the periphery. Each Graafian follicle consists of a tunica fibrosa and a tunica propria, the so-called membrana granulosa, lined with columnar cells and containing the liquor folliculi. Usually the membrana granulosa has a projection of cells, the discus proligerus, which contains the ovum proper. The ovum is made up of zona pellucida, yelk, germinal vesicle, and germinal spot (nucleus and nucleolus). The columnar cells im-

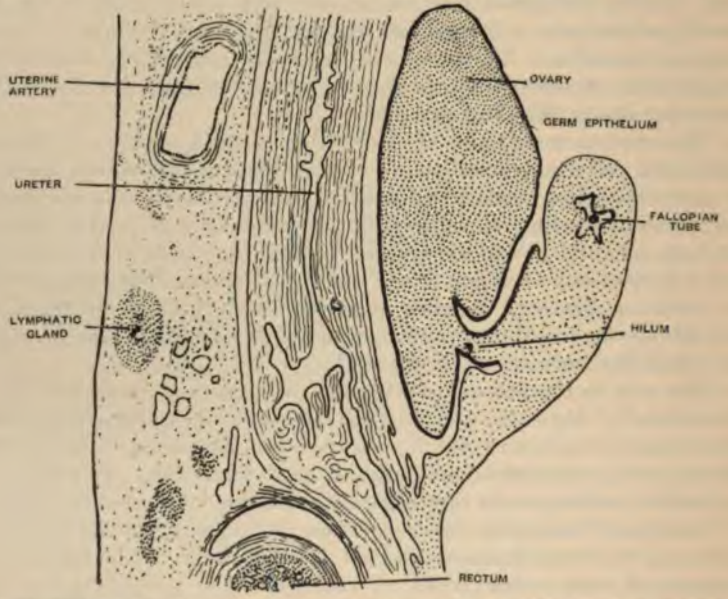

FIG. 19.—Sagittal lateral section of genital organs in 3½ months' fœtus. Note proximity of rectal and broad ligament connective tissue; the relations of ureter, ovary, and uterine artery are the same in the adult.

mediately surrounding the ovum form the corona radiata. The fresh nucleolus has been noted to show amœboid movements. The ovary lies in a shallow depression of peritoneum, the fossa ovarii. In some of the lower animals, such as the rat and seal, the ovary is surrounded by peritoneal capsule, and thus is shut off from the general peritoneal cavity. It is alleged that the same arrangement may occur in the human female, and be a source of tubo-ovarian cysts (Bland-Sutton). The connective tissue consists of round cells, and at the hilum are many blood-vessels.

Pelvic Peritoneum.—The upper aspect of the pelvic floor, the uterus, and its appendages are covered by peritoneum, the arrangement of which must now be described.

On sagittal mesial section the arrangement is as follows, from before backwards:—The peritoneum of the anterior abdominal wall is reflected on the fundus of the bladder a little above the level of the pubes. It then passes on to the anterior surface of the uterus, above the level of the os internum, over the fundus, and down the posterior wall of the uterus, which it covers completely. It dips down on the uppermost half-inch of the posterior vaginal wall, and finally becomes reflected upon the sacrum and rectum. The vesico-uterine pouch of peritoneum lies between the bladder and uterine wall. The posterior dip of the peritoneum below the level of the isthmus is known as the pouch of Douglas; it will be more fully described shortly. The vesico-uterine pouch has sometimes been erroneously termed the space of Retzius (Figs. 3 and 7).

The broad ligaments are formed by two folds of peritoneum passing out from the sides of the uterus to the side wall of the pelvis. The anterior fold of the broad ligament is a continuation of the peritoneum on the anterior surface of the uterus. Beneath it lies the well-known round ligament, which passes from the junction of the Fallopian tube and uterus, forwards and outwards to the inguinal canal. These round ligaments contain striped and unstriped muscular fibre, blood-vessels, and nerves. The posterior lamina of the broad ligament is in the same way a prolongation outwards and backwards of the peritoneum on the posterior surface of the uterus. It is larger than the anterior lamina, and lies partly on the side wall of the pelvis. Thus the ovary comes to lie both on the posterior aspect of the broad ligament and on the side wall of the pelvis. Between the layers of the broad ligament lie connective tissue, blood-vessels, lymphatics, and nerves; the connective tissue passing up into that of the iliac fossa. The so-called ovarian ligament joins the lower end of the ovary and the angle between tube and uterus; the uterine muscle passes into it. The Fallopian tube occupies the greater part of the top of the broad ligament. The infundibulo-pelvic ligament of the ovary is that part of the top of the broad ligament not occupied by Fallopian tube, and to a certain extent it suspends the ovary. The parovarium also lies between the layer of the broad ligament near the ampulla, and consists of a single longitudinal tube with several vertical ones. It represents the remains of the Wolffian duct and body, and will be more particularly alluded to afterwards. The utero-sacral folds are two ridges of peritoneum enclosing muscular fibre and connective tissue; they pass one from each side of the isthmus uteri, outwards and backwards towards the second and third sacral vertebræ. The pouch of Douglas can now be more accurately defined. Its upper lateral limits are the utero-sacral folds; in front the isthmus forms the top of the anterior boundary; behind is the peritoneum covering the sacrum and rectum. The occurrence of so many pathological products in the pouch of Douglas or its neighbourhood is to be explained not only by its affording a pouch for lodgment, but also by the near presence of the ovary; and above all by the position of the openings of the Fallopian tubes posterior to the broad ligament. Between the utero-sacral fold and the broad ligament lie the lateral pouches of Douglas, and on each side of the bladder there is a paravesical pouch.

V. The position of the organs: their dissection and structural anatomy.—The position of the organs is best ascertained and described in an adult pelvis which has been hardened and the superjacent intestine carefully removed. One of the best of these drawings has been recently published by Waldeyer (Fig. 20). The *uterus* lies below the level of the brim, usually to the one side, and is anteverted and anteflexed. Viewed from above, therefore, one can only see its fundus and posterior surface. The anterior surface touches the bladder, so that the vesico-uterine pouch is usually empty. The normal uterus is perfectly mobile, and its shape and normal relation to the vagina is a developmental one. Those who advocate ventro-fixations seem to forget entirely that the uterus is a mobile pelvic organ, and that after such operations it lies for a time in a state of abnormal position and fixation.

The *Fallopian tubes* pass, firstly, out towards the side of the pelvis; they then turn up, and the fimbriated end becomes applied to the posterior aspect of the ovary.

The *ovary* lies on the posterior lamina of the broad ligament, on the side wall of the pelvis, below the level of the brim, and in front of the sacro-iliac joint. The ovary on the side of the pelvis to which the uterus is inclined has its long axis vertical (Fig. 14); the other ovary has its long axis more or less transverse.

The *vagina* runs through the pelvic floor parallel to the conjugate. The part of the rectum in relation to the vagina and to the urethra is also parallel to the conjugate. The long axis of the anus is parallel to the axis of the pelvic brim. The external genitals in the upright posture make a small angle with the horizon.

Dissection of the Pelvis.—If a cadaver be placed in the lithotomy posture a dissection may be made over the rectal portion of the perineum, and also of the anterior urethral portion. When in the former case the skin is suitably removed, we come upon the superficial fascia with much fat, and the base of the ischio-rectal fossæ. If the fat, superficial vessels, and nerves be removed from these we then see that each fossa is bounded on the inside by the levator ani, and on the outside by part of the obturator internus. The varying portion of these boundaries is best seen on section (Figs. 7, 8, 9). Between them the sphincter externus can be dissected out. The pudic artery lies on the inner aspect of the ischial tuberosity. If the skin be now removed from the anterior urethral

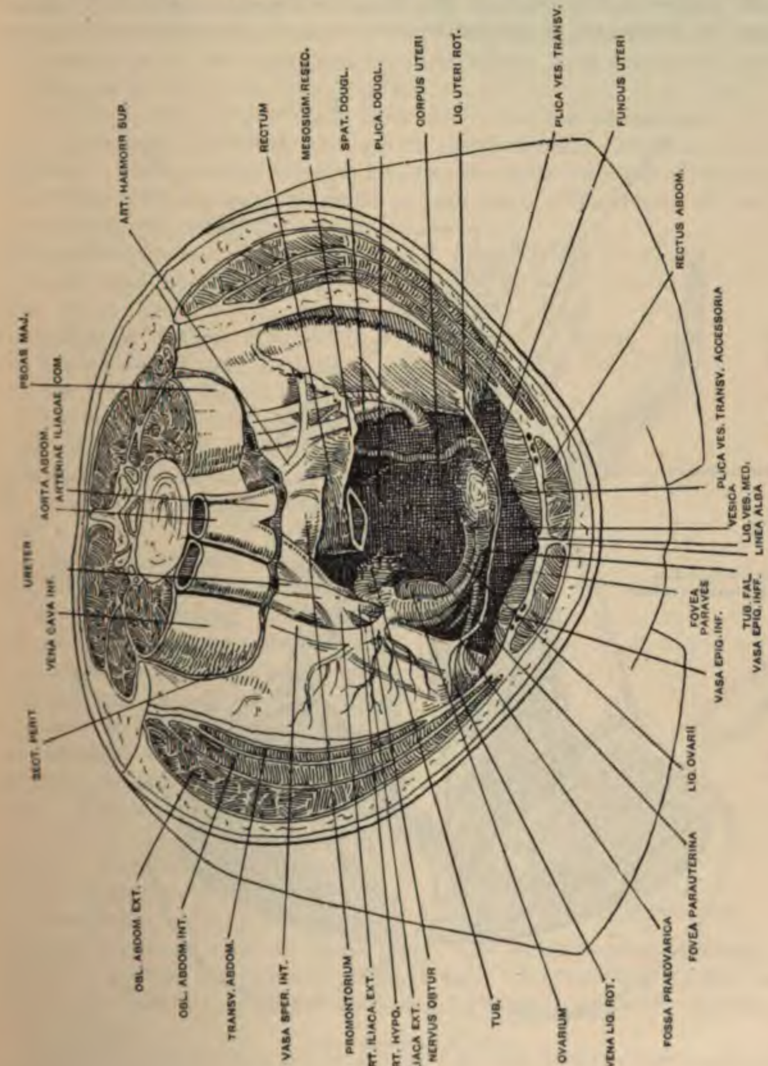

FIG. 20.—Pelvis and contents from above. (Waldeyer.)

portion we come first upon the superficial fascia, and then on the deep layer of the superficial fascia. This latter is attached to the pubic arch, its base hooking round the transversi perinei to join the anterior layer of the triangular ligament. On its removal we now see a double triangular arrangement of muscles, one on each side of the middle line. The base of each triangle is formed by the transversus perinei, the outer side by the erector clitoridis, the inner by the bulbo-cavernosus or sphincter vaginæ. Below the lower end of the bulbo-cavernosus lies the Bartholinian gland with its duct opening at the sides of the hymen. Higher than the Bartholinian glands, and still below the bulbo-cavernosus, lie the erectile structures known as the bulbi vaginæ. The removal of these muscles now exposes the anterior layer of the triangular ligament. This layer having been dissected off, we come upon the terminal branches of the

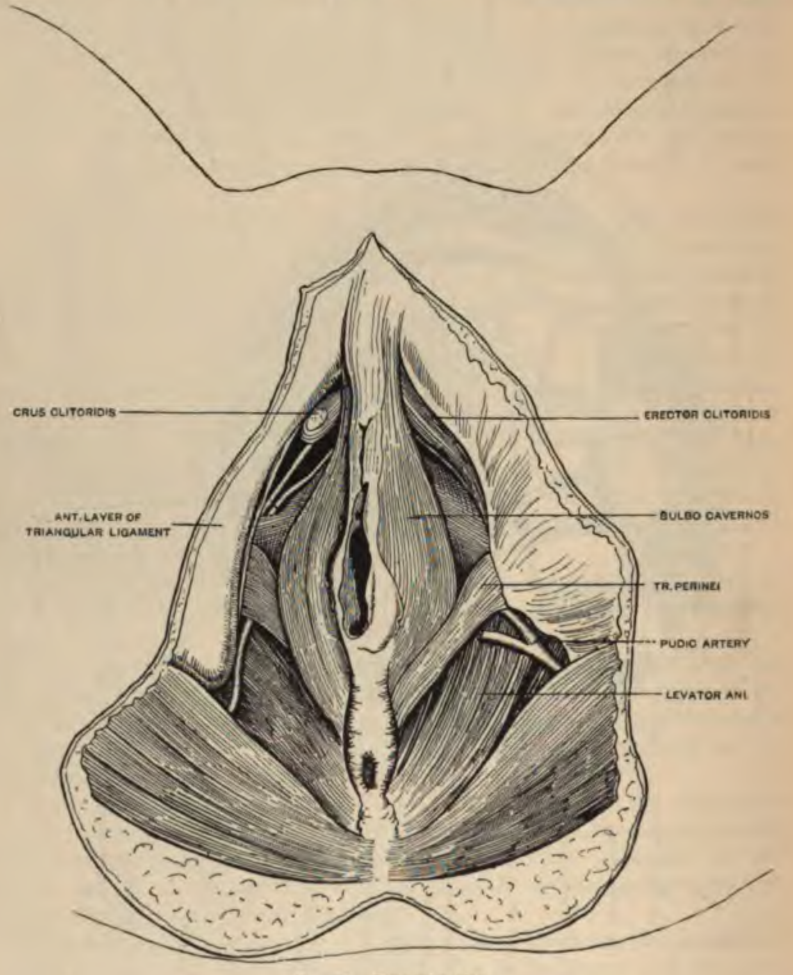

Fig. 21.—Perineal region.

pudic vessels and nerves lying on the posterior layer, and then cut into the retro-pubic fat. The exact relations of the fascia here have not yet, however, been accurately worked out. The triangular ligament undoubtedly acts as a supporting element to the urethra and vagina, which perforate it; and in the rare cases where a nullipara suffers from prolapsus uteri the edge of the triangular ligament, where it is perforated by the vagina, can be felt like a ring (Fig. 21).

If a dissection be now made from above, and the peritoneum, uterus, and appendages removed, the pelvic diaphragmatic muscles will be exposed. These are the coccygei and the levatores ani; and viewed from above they form a concave muscular arrangement. The levator ani has its origin from the posterior aspect of the pubes, from the white line of fascia and the ischial spine. The fibres pass down, almost vertically, to become attached to the vagina, the rectum, its fellow, and the tip of the coccyx.

The coccygeus has its origin from the spine of the ischium and passes to the lower part of the sacrum and front and side of coccyx.

The obturator internus is well seen in the sections (Figs. 7, 8, 9).

Structural Anatomy.—In sagittal mesial section the pelvic floor is an unbroken layer. The vagina and urethra do not impair its strength, as they are slits passing through it at right angles to the direction of intra-abdominal pressure. The floor, however, can be divided into two portions,—an anterior pubic mobile segement, and a posterior more fixed or sacral segment. The vagina thus forms a boundary between these two. The pubic segment consists of bladder, urethra, and anterior vaginal wall. Its mobility is due not only to the less firm nature of its tissue, but also to its loose attachment to the pubes.

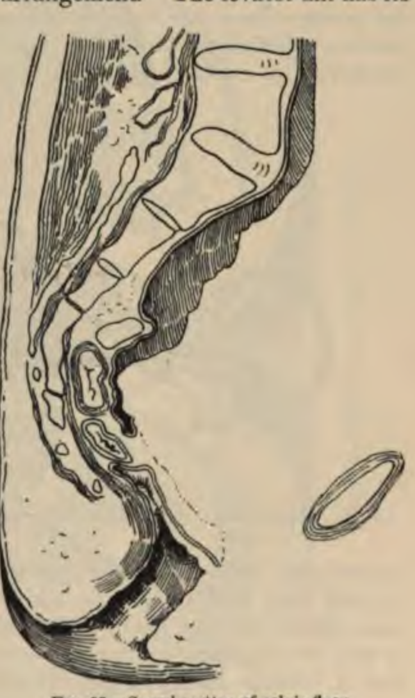

FIG. 22.—Sacral section of pelvic floor.

The sacral segment is firmly attached to the sacrum, and consists of the tissue behind the posterior vaginal wall, which is included in it. In the upright posture the sacral segment is the supporting one, intra-abdominal pressure pressing the pubic segment against it.

Changes in pelvic floor due to posture.—In the position known as the genu-pectoral the abdominal bulge lessens at the pubes and increases near the diaphragm. The projection of the pelvic floor is also less marked; but the pelvic floor is still unbroken. The following facts are now of great importance:—If the edges of the hymen be separated, air passes in and the vaginal slit becomes a cavity. The uterus if anteverted previously becomes more so, and lies farther from the vaginal orifice. The retroverted unfixed uterus does not become anteverted when a patient assumes the genu-pectoral posture and air is admitted into the vagina; but the uterus lies farther from the vaginal orifice and becomes more retroverted. These facts as to the dilatation of the vagina by posture give the key to proper specular examination, as was first shown by Marion Sims. The same dilatation of the vagina can be attained in the position known as Sims' semiprone posture, and also in the lithotomy posture, especially if the hips be raised. These postural methods are also invaluable in rectal and vesical examination. In the same way the rectum can be ballooned, and also, as Kelly has shown, the bladder. In this way, and by simple specula, thorough visual, and, in certain cases, digital examination of the bladder, vagina, and rectum can be made; as will be explained in the article on Pelvic Examination. In examination of bladder cases the genu-pectoral posture is advantageous, as well as in reposition of the gravid retroverted uterus.

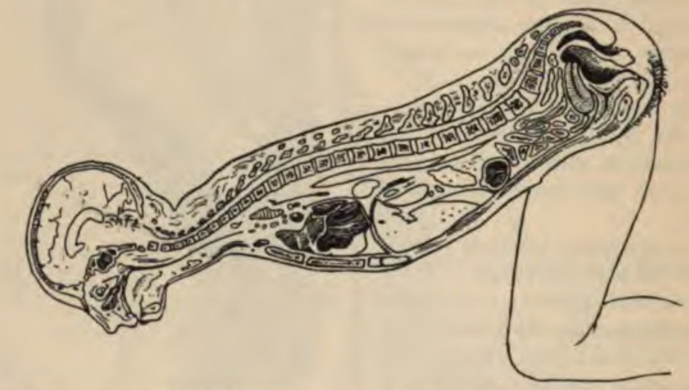

FIG. 23.—Diagram of genu-pectoral posture showing vaginal distension. (Based on frozen section.)

VI. Surgical anatomy.—In operative pelvic surgery by the vaginal route the following points must specially be kept in mind:—

i. *The posture of the patient and the mobility of the uterus.*—There is no doubt that the lithotomy posture is the most convenient for all operative work. By means of a broad, short, modified Sims' speculum the vagina may be dilated in this posture; and then with the volsella the uterus can in most instances be safely drawn near the vaginal orifice, and an accessible field of operation thus obtained. By most operators the use of the semiprone posture has been abandoned for the more convenient lithotomy one.

ii. *Blood-supply: Lines of loose connective tissue in the pelvis allowing the separability of the organs.*—In the flap operations on the perineum,

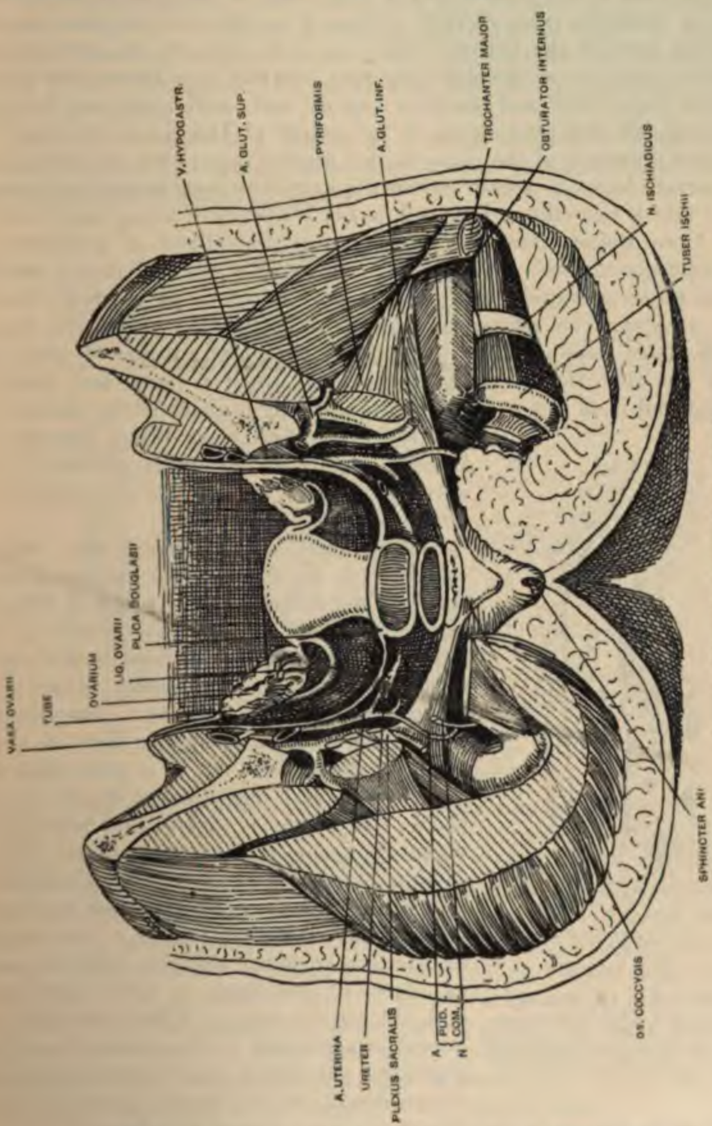

Fig. 24.—Dissection from behind. (Henke.)

now so generally adopted, the loss of blood is trifling. The bleeding is mainly venous, and is readily checked by pressure. In making the usual perineal incision with scissors it is advantageous to have the thighs well flexed on the abdomen, so as to render the parts tense. In suturing, the flexion should be less marked.

The lines of loose tissue in the pelvis are of the greatest importance from an operative point of view. Thus if a transverse incision be made over the base of the perineal body, so as to split it into anterior and posterior parts, the finger can then pass into the loose tissue between the anterior rectal wall and posterior vaginal wall; and these can be easily separated till the peritoneum of the pouch of Douglas is reached. In this way dermoids of the recto-vaginal septum have been enucleated, and also certain forms of deeply burrowing extraperitoneal gestation attacked. This route is one seldom followed, but it is worthy of being kept in mind. The loose union between rectum and vagina allows of posterior colporraphy operations. The operator can make a vertical mesial incision on the posterior vaginal wall until the loose tissue is reached; he can then separate the posterior vaginal wall laterally with the handle of his knife, remove what seems necessary, and suture. I must also point out that this loose union between anterior rectal and posterior vaginal wall is an important factor in allowing prolapse of the uterus. In the same way the loose tissue between the bladder wall and the upper portion of the anterior vaginal wall allows of anterior colporraphy.

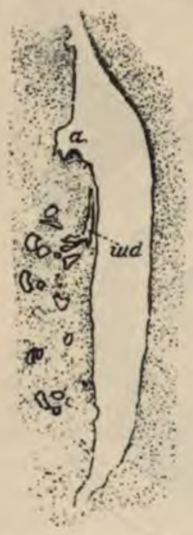

FIG. 25.—Sagittal lateral section of peritoneal cavity of human embryo a month old, showing Wolffian body and duct (*w.d.*), also probable head kidney rudiment (*a*).

In vaginal hysterectomy the operator readily cuts by a transverse incision through the posterior fornix into the pouch of Douglas, as the thickness of tissue here is only $\frac{1}{3}$ inch. Anteriorly a transverse incision in the vaginal fornix exposes the loose tissue between the bladder and cervix, and the vesico-uterine pouch can soon be opened. Here as a rule little bleeding arises, but it is quite otherwise with the lateral attachments of the cervix; there the tissue is dense and abundantly vascularised by the uterine artery. Before cutting the lateral attachments, therefore, it is imperative for the operator either to ligature or to apply pressure forceps: the anatomy of the ureter must also be kept in mind, as there is less than $\frac{3}{5}$ inch between it and the cervix uteri. When once the firm lateral attachments of the cervix have been separated the uterus can be more thoroughly drawn down, and the broad ligaments secured in the same way as in the case of the lower lateral attachments.

Operations on the upper part of the vulva are usually superficial, as in clipping away irritable skin in pruritus vulvæ. The bleeding is usually insignificant, even if the glans clitoridis be cut off. The operator must beware of cutting below the apex or sides of the pubic arch.

In abdominal surgery the anatomy of the incision in the linea alba needs no remark. In pelvic adhesions the operator must be specially careful in the neighbourhood of the sacro-iliac joint and side of the pelvis owing to the position of the ureter here, and to the proximity of the large iliac vessels.

Recently Dührssen and Martin have recommended in certain cases, instead of abdominal section, incision by way of the loose tissue between the bladder and the uterus.

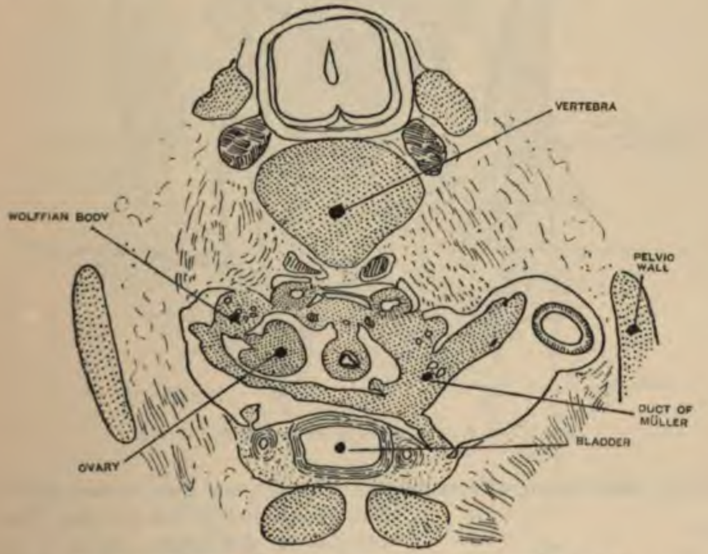

FIG. 26.—T. S. pelvis, six weeks' fœtus. Note wide transverse of pelvis.

VII. Development of the Organs.—The subject of the development of the female genital organs is too complex to admit of full consideration here, and I shall therefore only take up some points of practical importance. In a human embryo of the fourth week (Fig. 25) the peritoneal cavity (cœlom) with the Wolffian body showing its tubules and ducts is well seen. In a six weeks' embryo prepared for me by Dr. Gulland it can be seen that these have diminished in size, and are represented only by a few tubules; while the ovary, pedunculated and with well-marked germ-epithelium covering it, can be noted (Figs. 26 and 28). The broad ligaments with the duct of Müller can also be seen.

Lower down in the pelvis the genital cord is displayed (Fig. 27); and at this stage one can note three canals in it; the centre one being formed by the coalesced ducts of Müller, while each lateral one is the Wolffian duct. This agrees, therefore, with the usual statement that in the embryo there are two sets of organs—the Wolffian bodies with their ducts, and the ducts of Müller. The former atrophy in the female sex, but leave their traces in the broad ligaments, where are normally found the parovarium, or epoophoron (Fig. 28), and also certain additional but occasional relics in the form of tubules at the hilum; or of a special tube in the broad ligament, uterus, or vagina, rarely continuous in all of them, known as Gartner's canal. It represents the Wolffian duct, and may be a source of retention cyst in the localities already named; it is normally present in the cow and sow.

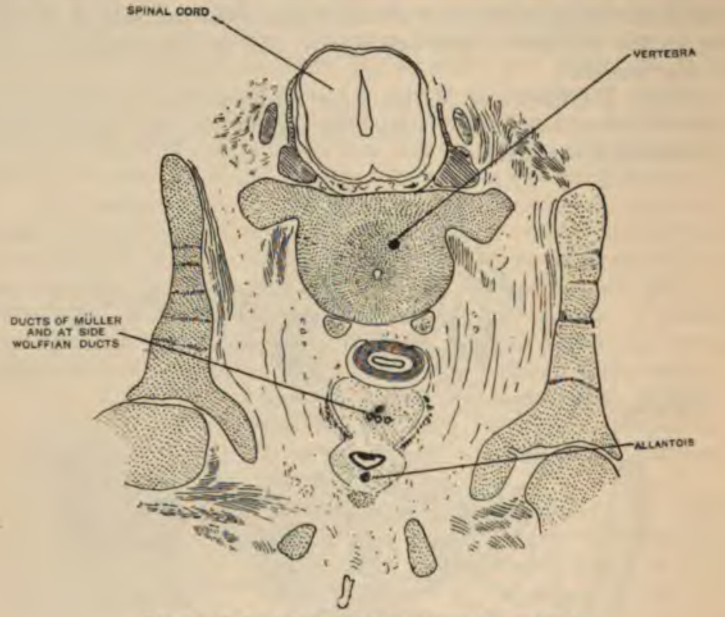

FIG. 27.—T. S. of six weeks' fœtus showing genital cord.

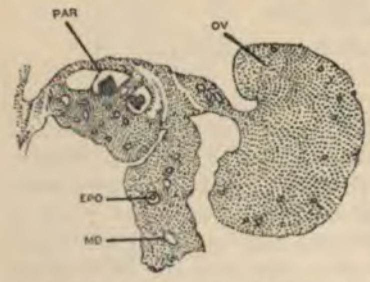

FIG. 28.—Section of ovary and Wolffian body, human embryo, third month. (Nagel.) *md*, Duct of Müller; *par*, paroophoron; *epo*, epoophoron (that is, parovarium).

Ovary.—The ovary arises as a specialised thickening on the Wolffian body. Its outer covering is the "germ epithelium," and this is derived from the peritoneal covering of the Wolffian body. The ova are due either to an ingrowth of the germ epithelium into the ovary, some of the cells (preformed) giving rise to the ova, the others to the membrana granulosa; or to an outgrowth of the connective tissue from the ovary snaring in the germ epithelium. This was Foulis's view, and he also held that the cells of the membrana granulosa were derived from the ovarian connective tissue.

The *ducts of Müller* give rise to the Fallopian tubes, uterus, and vagina. They remain separate to form the tubes, and coalesce to form the uterus and vagina. Disturbance in this normal coalescence gives rise to malformations. According to some anatomists, the Wolffian ducts enter into the formation of the vagina, and give rise to the H-shape on transverse section. As the diagram shows, the ducts of Müller forming the vagina at first have a lumen; but by epithelial proliferation from the Wolffian bulbs they become solid. At the lower part of the vagina there develop about the third and a half month two special oval epithelial proliferations, which break down centrally and thus form the hymen (Fig. 29). These bulbs I have recently found to be developed from the

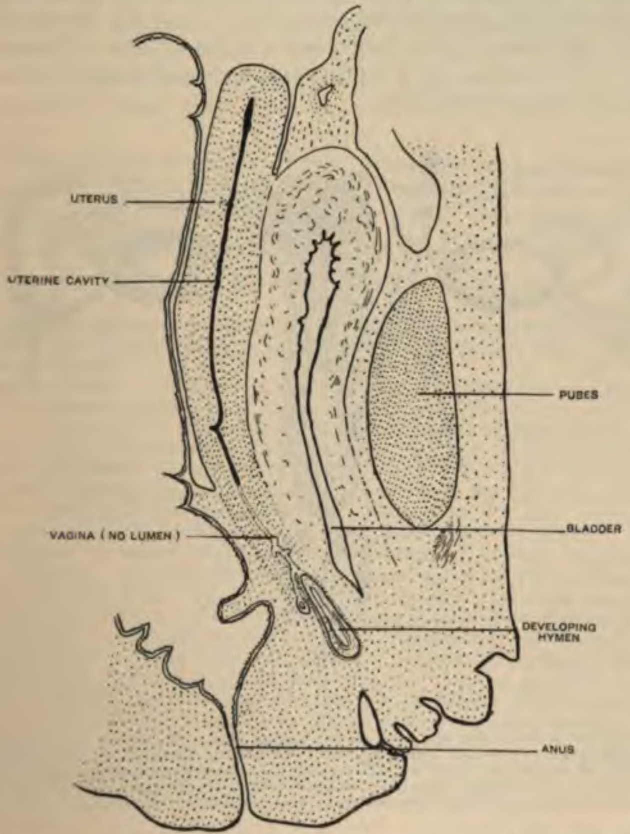

FIG. 29.—L. S. of 3½ months' fœtus to show development of hymen. This shows formation of hymen by development of two bulbs from Wolffian ducts: these join and break down in the centre, and are met by an involution of hypoblast below.

Wolffian ducts, and I have termed them the Wolffian bulbs. This figure also shows the involution of the deeper layers of the vestibule to meet the hymen. About the fourth or fifth month the solid vaginal proliferation flattens out, and then forms a lumen. I believe, however, that it may do so earlier (Figs. 27 and 29).

In the early fœtus (fifth to sixth week) a cloaca is present; the Wolffian ducts open into the urino-genital sinus (Fig. 27) up till the third month, when they are closed by the development of the hymen. The subsequent stages are the formation of a septum and the development of the clitoris in front, and labia at the sides.

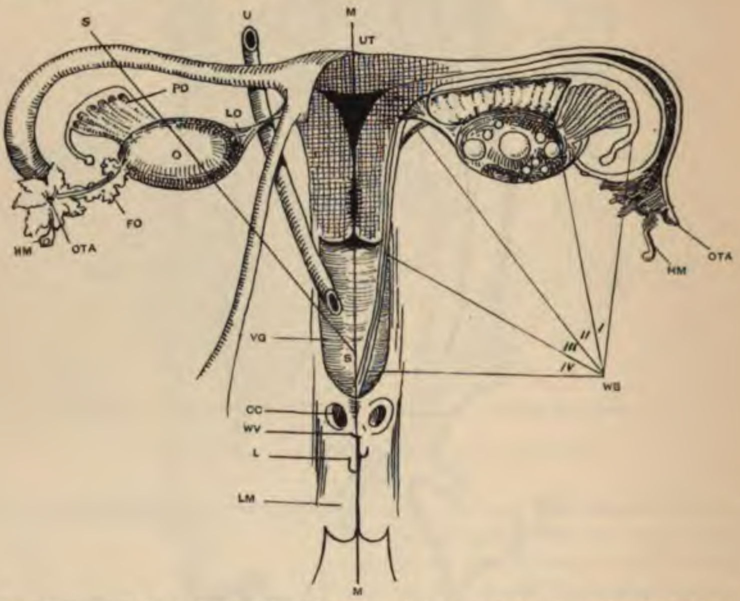

FIG. 30.—Diagram of developing and fully formed genital tract. *ota*, ostium tubæ abdominale; *hm*, hydatis Morgagni; *fo*, ovarian fimbria; *o*, ovary; *lo*, ovarian ligament; *po*, parovarium; *lr*, round ligament; *vg*, vagina; *wv*, upper wall of vestibule; *cc*, corpus cavernosum clitoridis; *u*, ureter; *l*, labium minus; *lm*, labium majus; *wb*, Wolffian body. On the right side are seen the normal organs, on the left the Wolffian-body relics and duct in addition. (Coblenz.)

The relation of the pelvic organs to the germinal layers is of interest. The uterus, tubes, and ovary are mesoblastic; the adult vagina has its lining derived from the epiblast, the lower involution from the local outer covering, but the lining above the outer aspect of the hymen is furnished, as an examination of my specimens seems to me to demonstrate, through the Wolffian duct. The Wolffian duct is really epiblastic in its origin. The anus is also epiblastic, while the bladder and rectum are hypoblastic. The vestibule is derived from the urino-genital sinus, and is hypoblastic.

The main practical points resulting from this development are as follows:—

1. Normally in the adult woman we find traces of the Wolffian body and duct in the parovarium (Fig. 30). This is the source of the ordinary parovarian tumour.

2. Skene's tubules in the urethra are probably not Wolffian relics, but represent the glands of the male prostate.

3. Abnormal relics of the Wolffian body at the hilum of the ovary, and in the broad ligaments, may give rise to papillomatous developments. Some authors, however, consider the germ-epithelium as more probably the source of these when they are present in the ovary.

4. Gartner's canal may give rise to broad ligament, uterine, and vaginal cysts.

5. Malformations are really due to persistent stages of arrested development.

D. Berry Hart.

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The following references do not represent Gynæcological anatomy, but merely the main sources used in this sketch. Fuller sources are indicated, and should be consulted when necessary.

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D. B. H.

METHODS OF PELVIC EXAMINATION IN WOMEN

In this section we take up the methods of examination necessary to diagnose gynæcological disease. The diagnosis of the various diseases comprised in Gynæcology is not considered, but in some instances special points may be gone into so far as they are necessary to explain methods and symptoms.

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INTRODUCTORY REMARKS

In investigating the case of a female patient, we have to settle in the first place what will indicate to the practitioner that the case is gynæcological, and requiring pelvic examination. This done, the gynæcologist is free to apply the various methods to be described, so far as they seem necessary in each special case.

The patient is usually seen at some age from puberty onwards, and makes complaints referable to the abdomen or pelvis, or gives an account of some disturbance of her natural functions. She may even be more precise, and refer her illness to something connected with the womb or adjacent parts. The practitioner thus gets the clue, and begins to investigate the case from the gynæcologist's standpoint.

He must note fully what the patient complains of. She should be encouraged to state this as precisely as possible, and the practitioner should always remember what her complaints are, so as not to lose her confidence by any *lapsus memoriæ*.

Although the complaints made under such circumstances vary very much, they may be arranged practically as follows :—

1. *Distinct complaint of some abdominal swelling* leading necessarily to special investigation to be described afterwards.

2. *Pain.*—This is the most common complaint. The sites of sympathetic pain in gynæcology are definite, viz. (1) in the left iliac fossa ; less often in the right ; this is usually called, although with little real evidence, "ovarian pain" ; (2) beneath the left mamma—a very characteristic site, and one to which much importance was formerly attached ; and (3) over the sacrum or coccyx (Herman). Again, there may be pain with the menstrual period, either before, during, after it, or occasionally between the periods—the intermenstrual pain, or "Mittelschmerz" of German observers. A periodic daily pain is characteristic of some forms of cancer of the corpus uteri.

3. *Discharge of Blood.*—When excessive at the period (menorrhagia) its most common cause is fibro-myoma uteri, or some form of endometritis ; when extending beyond the period (metrorrhagia) it is more characteristic of malignant disease of the cervix or body of the uterus ; when preceded by some months of amenorrhœa, investigation must be made as to abortion or extra-uterine gestation. Bleeding coming on after coitus (apart from first intercourse, when it is probably due to some laceration of the hymen) is very characteristic of early malignant cervical disease.

4. Finally, the patient may complain of *white discharge*, of *local vulvar swelling*, or of *falling of the womb*, and thus indicate that the case is of a gynæcological nature. In children white discharge is usually vulvar ; in adults uterine ; in old women vaginal.

Symptoms such as these will, therefore, determine roughly the line of investigation, and, accordingly, the further anamnesis must be ascertained systematically.

The special points to be noted are as follows:—The *age* of the patient helps to a limited extent. Thus at puberty we might expect conditions determined by developmental lesions (atresiæ, menstrual retentions in various segments of the genital tract), while in a woman in her full sexual vigour we are more likely to meet with inflammatory conditions, the results of birth lacerations and so on. Malignant disease has, roughly speaking, a calendar of occurrence; we may meet with it before puberty, but not often. The average age for deciduoma malignum is 32; cervical cancer, 40 to 50; malignant disease of the body of the uterus, 50 to 60 and beyond; vulvar cancer, 60 to 80. An experienced practitioner must have seen many exceptions to this age scheme, but in the majority of cases it holds good with a rough sort of accuracy.

The appearance of the patient is often helpful. We have the anæmia of the woman who loses blood unduly, and sometimes in those who have lost profoundly, a ghastly facies with a yellowish tinge. The patient with a long-standing ovarian tumour has often a pinched look—"facies ovariana," pictured by Spencer Wells and others; or where sacral pain from pressure is excessive she may have the characteristic stoop. All these points are helpful, but the man who relies on them rashly will often be put to shame. Sometimes a patient with malignant disease fairly advanced, but not breaking down and not infiltrating the pelvis, may have quite the look of health, and make little characteristic complaint.

Inquiry should always be carefully made as to the *starting-point of the affection*. Thus pain and discharge with bladder irritation, coming on after marriage, will suggest latent gonorrhœa on the part of the husband as a cause; these symptoms coming on after abortion or labour will suggest some labour laceration or puerperal infection. History must, therefore, never be poohpoohed, but receive its due value, although at first its significance may not be seen. When menstruation has been irregular the exact dates must be got as far as possible. This symptom is of great importance in relation to those disturbances of extra-uterine gestation usually classed as hæmatocele.

I append a scheme used in the University and Extra-academical gynæcological wards of the Royal Infirmary, Edinburgh, which gives a basis for the extended examination.

DISEASE

Anamnesis.

1. Name; Age; Occupation; Residence; Married, single or widow; Date of admission.
2. Complaint and duration of illness.
3. General history of: (*a*) Present attack; (*b*) Previous health; (*c*) Diathesis; (*d*) Social condition and habits; (*e*) Family health.

4. Sexual history :
   - (1) *Menstruation*—
     - A. Normal : (*a*) Date of commencement ; (*b*) Type ; (*c*) Duration ; (*d*) Quantity ; (*e*) Date of disappearance.
     - B. Morbid : (*a*) Amenorrhœa ; (*b*) Menorrhagia ; (*c*) Dysmenorrhœa.
   - (2) *Intermenstrual Discharge*—(*a*) Character ; (*b*) Quantity.
   - (3) *Pregnancies*—(*a*) Number ; (*b*) Dates of first and last ; (*c*) Abortions ; (*d*) Character of labours ; (*e*) Puerperia ; (*f*) Lactations.
5. Local functional disturbances : (*a*) Bladder ; (*b*) Rectum ; (*c*) Pelvic nerves and muscles.
6. General functional derangements : (*a*) Nervous system ; (*b*) Respiratory system ; (*c*) Circulatory system ; (*d*) Digestive system ; (*e*) Emunctories.

PHYSICAL EXAMINATION

1. General appearance and configuration.
2. Mammæ.
3. Abdomen : (*a*) Inspection ; (*b*) Palpation ; (*c*) Percussion ; (*d*) Auscultation ; (*e*) Mensuration.
4. External pudenda.
5. Per vaginam : (*a*) Orifice ; (*b*) Walls and cavity ; (*c*) Roof ; (*d*) Os and cervix uteri.
6. Bi-manual examination (abdomino-vaginal, abdomino-recto-vaginal)—
   - (1) *Uterus :* (*a*) Size ; (*b*) Shape ; (*c*) Consistence ; (*d*) Sensitiveness ; (*e*) Position ; (*f*) Mobility ; (*g*) Relations.
   - (2) *Fallopian tubes.*
   - (3) *Ovaries :* (*a*) Size ; (*b*) Situation ; (*c*) Sensitiveness.
   - (4) *Peritoneum and cellular tissue.*
   - (5) *Bladder.*
   - (6) *Rectum.*
   - (7) *Pelvic bones.*
7. Use of : (*a*) Speculum ; (*b*) Volsella ; (*c*) Sound.
8. Physical changes in : (*a*) Nervous System ; (*b*) Respiratory ; (*c*) Circulatory ; (*d*) Digestive ; (*e*) Bladder and bowel ; (*f*) Skin ; (*g*) Bones.

Diagnosis—Prognosis—Treatment—Progress and Termination.

So far the practitioner will probably have ascertained sufficient facts to warrant an examination, and this to be systematic should comprise—

I. Abdominal examination.
II. Inspection of the external genitals.
III. Vaginal examination.
IV. Bimanual examination of the genital organs in its various forms.
V. Instrumental examination of the genital organs.
VI. Simple and Instrumental rectal examination.
VII. Additional means of examination ; blood count ; staining for micro-organisms.

All these may be necessary only in a few cases, in most perhaps two or more only may be required. Pelvic examination itself is a matter of some delicacy, and thus we have first to settle what cases are suitable for it. Women understand as a rule that the term "examine" involves vaginal examination.

As a general rule we may "examine" gynæcologically—

1. Married women whose symptoms point to a pelvic cause.
2. Unmarried adult women with urgent pelvic symptoms.
3. Girls at puberty with symptoms pointing to menstrual retention.

In the unmarried, the mother, sister, or some female friend should be present as a rule, and the patient should understand what is involved in the examination. In the case of the young girl the consent and presence of some responsible person is imperative.

Women are not to be examined for a trivial cause. Professional *noblesse oblige* comes in here.

No maidservant should be examined merely at the request of a mistress, as, for instance, in a case of suspected pregnancy. The medical man has to do with no one in such a case but the patient and her legal guardian, both of whom must be aware of what is proposed, and consent to it.

These points being settled, the investigation should begin with—

I. ABDOMINAL EXAMINATION

In all cases this should be the first step. Mistakes not infrequently arise, and important conditions may be missed if this method is omitted or cursorily performed.

For its accurate performance the anterior abdominal surface is divided into certain areas, nine in number, by special artificial lines—horizontal and vertical. A vertical line on each side, from the cartilage of the eighth rib to the centre of Poupart's ligament, with an upper transverse at the level of the tenth costal cartilage, and a lower, either joining the anterior superior spinous processes or the prominent points of the iliac crests (viewed from the front) a little higher up, give us nine areas named as follows:—1. Right Hypochondriac; 2. Epigastric; 3. Left Hypochondriac; 4. Right Lumbar; 5. Umbilical; 6. Left Lumbar; 7. Right Iliac; 8. Hypogastric; 9. Left Iliac. (*Vide* Figs. 31 and 32.)

The relation of the abdominal viscera to these various areas is given in the usual anatomical text-books (Schäfer, Cunningham), while that of the special pelvic organs will be found at pp. 38 to 42 of the present System.

Performance of abdominal examination.—The patient loosens her dress, corsets, and skirts, and lies down on the couch on her back; the body is covered with a rug, the head supported on a pillow, and the knees drawn up. She should not strain, but breathe regularly and easily. The examiner then exposes the abdominal surface by turning down the rug and suitably arranging the clothing. The pubes should be covered.

The surface of the abdomen is then examined by *Inspection*, *Palpation*, *Percussion*, and *Auscultation*.

Inspection.—The whole surface is carefully looked at, its bulge noted, and any prominence, with its shape, observed. We may have the slight lower bulging of the well-made woman; the scaphoid condition of the emaciated, the bulging and lateral overhanging of the stout patient, or the marked prominence where a large tumour is present. One can note the right lateral obliquity of the advanced pregnant uterus, the rounded and gradually sloping-off contour of the ovarian, or the more abrupt outlines of the fibroid tumour.

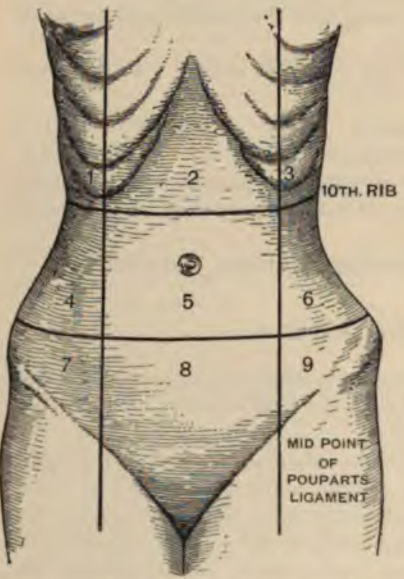

FIG. 31.—Abdominal areas. (D. J. Cunningham.)

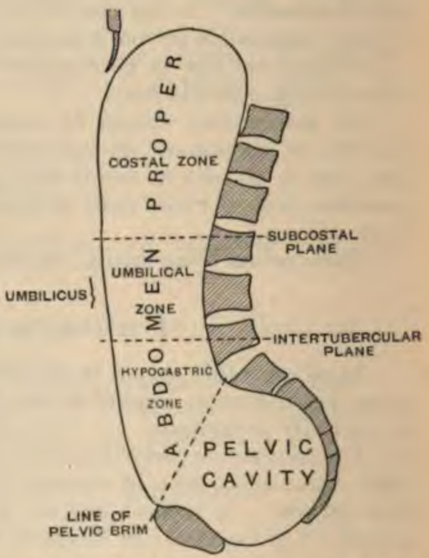

FIG. 32.—Abdominal zones seen in sagittal mesial sections. (D. J. Cunningham.)

The condition of the navel, presence or absence of striæ, either those of mere distension or those associated with past or present pregnancy; cicatrices of former operations, the linea nigra, œdema, etc., need only a passing note. The fresh striæ of pregnancy have a pearly lustre, those of former pregnancies are a dull white.

Palpation.—This is a most important form of examination, and should be performed as follows:—The examining hands are cleansed and warmed. With one hand first, the contour of the abdominal surface is felt, and then pressure is made downwards and all over so as to feel abnormal resistances or swellings. It must not be forgotten that the sacral promontory lies at no great depth from the surface skin (1½″-1″ deep), and is not to be diagnosed as an abnormality as is sometimes done by the student. If the middle finger be pressed down on it, and the thumb on the pubes, it is evident one can directly measure the "conjugate." Another normally felt structure, the "aorta," with its visible pulsation in nervous women, has been described by the inexperienced as "aneurysmal."

Both hands are now employed to map out the outline and feel the consistence of any tumours. With one hand laid flat on one side, a rapid "flick" is made with the index finger of the other at a distance; a fluid thrill or impulse may thus be detected. To eliminate the fallacy of the conveyance of the impulse along the abdominal walls, the ulnar edge of an assistant's hand may be placed on the skin midway between the examining hands. This impulse is best felt when free abdominal fluid is present in large amount; is especially well felt in the thin-walled parovarian tumour with its watery contents, less well in the ovarian tumour with its denser fluid. It is very difficult to separate tumours with colloid contents from semisolid ones; soft fibroids also often give a deceptive sense of fluctuation. The ordinary fibroid has a very firm, dense consistence. All irregularities in the tumour must be carefully noted, and in connection with some cystic tumours it must not be forgotten that the uterus, not much if at all enlarged, may be raised up into the abdominal cavity.

Alternate hardening and softening in a tumour is characteristic of advanced pregnancy; here we can map out the fœtal parts and listen for the fœtal heart, etc. in confirmation. This hardening and softening has, however, been felt in soft fibroids.

Percussion is performed in the ordinary medical way, along both vertical and transverse lines. Tumours and fluid effusions give a dull note, the bowel a tympanitic or subtympanitic one. In this way the contour of tumours and effusions can be outlined and marked with colour for future comparison. In ovarians the contour is more or less circular, in fibroids somewhat pear-shaped, in free ascitic fluid dulness extends from side to side, and presents a downward concavity as contrasted with the upward convexity of the ovarian or fibroid. Irregular scattered dulnesses accompanied with intestinal distension in varying amount, are suggestive, if the bowels be clear, of malignant or tuberculous peritonitis.

It is of great importance to percuss not only with the patient in the dorsal posture, but also in the left lateral and right lateral positions. In cystic or solid tumours, or in encysted fluids, no change in the area of dulness will be found, but there will be marked changes where there is free peritoneal fluid-ascites. Here, when the patient is in the dorsal posture, there will be dulness from side to side, and the upper limit of the dulness, concave downwards; but when the patient turns on either side the dull note will be on the lower side, the clear note above. Evidently the small intestine floats on the free fluid. Finally, if the patient grasps the examiner's hands and raises herself in this way, the recti muscles will flatten somewhat, a change which does not happen in cystic or solid tumour.

Percussion repeated at intervals of days is of value in some cases. Phantom tumour is, of course, cleared up at once by percussion, as the patient, although she may simulate the protrusion of a tumour in a way not well understood, cannot simulate its dull note.

Auscultation is valuable in pregnancy where after the fifth month the fœtal heart sounds, uterine souffle, and funic souffle (from pressure on cord between stethoscope and child's body) may be heard. In fibroids a souffle is heard, but not in cystic tumours, unless the broad ligament with enlarged veins has been twisted up and lies below the abdominal surface.

The same methods are applicable to the examination of the spleen, liver, kidney, and colon, but this is beyond the scope of the present chapter.

The next step in the examination is, in certain selected cases,

II. EXAMINATION OF THE EXTERNAL GENITALS

This is necessary in a few cases only, as for example when the patient in such conditions as urethral caruncle, labial boils, soreness, etc., makes a distinct reference to the external genitals. In hospital cases it is more necessary because of the greater frequency of gonorrhœa and syphilis, and in such cases the examiner must, for obvious reasons, be careful not to infect his fingers.

We may here note, however, that great care must be taken as to cleanliness of the hands, which should be carefully washed before and after every examination. It is best not to use disinfectants every time, as under their use the fingers are apt to harden and crack, but soap and water should be freely employed. When the hands become rough and sore they should be rubbed with glycerine, and gloves worn at night.

The patient is asked to turn on her left side, and to draw the knees well up; then, under the rug, the examiner raises up the dress, first bringing it over the knees and then drawing it back so as to expose the parts. The condition of the labia majora and perineum is noted, and then the labia are separated and any further abnormal conditions observed. There may be prolapsus uteri, protruding cervical hypertrophy, various labial growths, various degrees of perineal tear, local boils or abscess of Bartholin's gland, gonorrhœal warts, mucous patches of syphilis, atrophy and cracking of mucous and skin surfaces in old women (Kraurosis vulvæ), various skin eruptions, pediculi, etc. Tear of the perineum, specially when involving the anus, should be carefully noted. When the external sphincter is intact the skin over it is wrinkled and continuous; but when torn, the wrinkled skin forms a crescent posteriorly, exposing the anal and rectal mucous membranes.

The next stage in the examination is the important one of

III. VAGINAL EXAMINATION

The patient lies on her left side and the dress has already been so arranged that access to the genitals is free. The fingers (index and middle) of the right hand, lubricated with vaseline or preferably with soap and hot water, have now to be passed into the vagina. In an unmarried woman the index alone should be used, but in the married or parous woman both are employed. The dorsal aspect of these fingers is passed from behind forwards, and thus touch lightly the cleft of the hips, the anus, and base of perineal body, until the entrance to the vagina is reached.[1] They are then made to enter gently, passing backwards until the roof of the vagina is felt. The state of the orifice, whether patulous or narrow; the temperature, moisture, presence or absence of foreign bodies, such as pessaries and plugs; any abnormal septa, fistulæ, indurations or tumours (such as tumours of the vaginal walls, uterine polypi, the inverted body of the uterus) are noted, the fornices explored, and their depth, or any pelvic swelling in them, observed. Through the anterior fornix the finger may feel the body of the uterus either normal or increased in size.

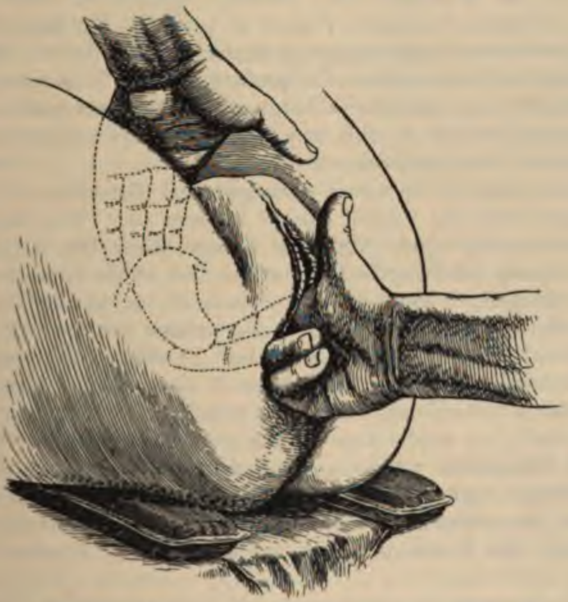

FIG. 33.—Performance of bimanual with patient in lithotomy posture. (H. A. Kelly.)

The cervix, with its os externum, is next carefully felt, and facts as to its shape, size, direction, whether or not the os is normal in shape, or the cervix lacerated, or thickened and expanded, or excavated, ascertained (*vide* Figs. 3 and 17 for some of the terms used). While the examiner keeps his finger in the vagina the patient is now asked to turn on her back so that the "bimanual examination" may be done. After some practice the vaginal examination may be made from the first with the patient in the dorsal posture and the limbs drawn up, and this makes it easier on the whole for her.

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[1] This plan only applies to cases where mere examination is being made.

IV. BIMANUAL EXAMINATION IN ITS VARIOUS FORMS

This is the most important form of pelvic examination, and to acquire proficiency in it requires a great deal of practice. Its importance cannot be over-estimated, but it may not enable one to get all the information required, and it is here the use of the sound, speculum, etc. comes in.

Abdomino-vaginal bimanual: Posture of patient.—The patient must lie on her back with the head supported and the limbs bent. She should breathe easily, and not strain. In performing the bimanual the inner and outer hands work together, the inner elevating the parts, the outer depressing them, so that in this way the organs are mapped out in all their normal and abnormal relations.

The inner hand is to be so arranged that the index, or index and middle fingers lie in the vagina, palmar surfaces up. The thumb lies in the fold between the right thigh and labium, while the ring and little fingers are usually best disposed of in the cleft of the hips, or they may be bent on the palm. The sensitive clitoris is not touched in this way. The upper hand, warm, is placed over the various lower abdominal areas above the inner fingers, the palmar surface of course touching the skin. Gentle, but firm pressure is made with it always in a direction from behind forwards, not merely behind the pubes. The bimanual examination is practically an exploration of the pelvis through the roof of the vagina and abdominal walls, and we divide the roof into the four fornices, anterior, posterior, and lateral, through each of which the examination is systematically made. As the vaginal walls are normally in apposition, the fornix is really made artificially by the examining fingers.

Through the *anterior fornix* (not *in* the anterior fornix, as is so often inaccurately said) one may feel the anterior surface of the body of the normal uterus. The upper hand in the hypogastrium being now gently but firmly depressed, the uterus can be mapped out and felt lying anteverted and anteflexed, and usually with a slight right lateral obliquity (*vide* Fig. 20).

In abnormal cases the uterus may be felt enlarged (subinvolution, pregnancy tumour conditions); rarely do we feel inflammatory or blood effusion through this fornix, but sometimes the ovary may be felt. If the upper fingers are dipped in close behind the pubes the uterus may be artificially retroverted.

Through the *lateral* fornices one may feel normal bands running from cervix to side pelvic wall, the bases of the broad ligament (*ligamenta cardinalia*). The lateral fornix is the region above which the uterine artery lies close to the cervix, while the ureter is about half an inch from the cervix (*vide* Figs. 8, 10, 24). Through the fornix one may palpate out the ovaries. Schultze recommends the right fingers to be used internally for the right ovary, the left for the left ovary, but this procedure is usually unnecessary. To map out the left ovary one presses up the internal fingers, while the outer fingers, at a point midway between psoas edge and right uterine angle (*i.e.* junction of tube and uterus), are firmly depressed, when both hands working from behind forwards can usually roll the ovary between them. Normally it is the size of a filbert nut, but when larger or prolapsed is more easily felt. Pressure may produce a characteristic sickening pain. In specially favourable cases the ovarian ligament and isthmus of the tube may be felt (Figs. 20 and 24).

The chief *abnormal* bodies felt may be ovarian, parovarian, or broad-ligament cysts; solid ovarian tumours; broad-ligament effusion (blood, pus, or extra-uterine gestation); tubal conditions (pyo-hydro-hæmato-salpinx, tubal gestation). One must first always, if possible, outline the uterus separately, note its relation to the swelling, and then elucidate the nature of the tumour from its shape and mobility, together with the history.

Through the *posterior* fornix one, as a rule, feels the largest number of abnormal products. This is because the pouch of Douglas is separated from the fornix by only about one-third of an inch of tissue, and the ovary, tube, and ostium abdominale, all in close relation to the posterior lamina of the broad ligament, lie near it. Thus enlarged ovaries, distended tubes, and exudations from infective conditions of the uterus and tube soon reach the pouch of Douglas (*vide* Figs. 3, 15, 20, 24), and can be felt by the vaginal finger to bulge it.

Normally, little is felt through the posterior fornix, but sometimes one can map out the utero-sacral folds. The abnormal conditions are very many; we enumerate them in a rough order of frequency: (1) Fæcal matter in bowel; (2) body of retroflexed uterus, normal in size, or enlarged by tumour or pregnancy; (3) prolapsed ovary or ovaries; (4) distended tubal conditions, tubal pregnancy; (5) ovarian or parovarian cysts; (6) inflammatory conditions—peritonitic, cellulitic; actinomycotic (very rare); hydatids (rare); (7) congenitally misplaced kidney or spleen (excessively rare), etc.

The first point, as already said, is to outline the uterus and make out its blending with or separability from other swellings present. Then a further differentiation is made from facts ascertained in the history, and from the shape, size, consistence, fixation, etc. of the abnormal bodies (Fig. 3).

Finally, the bladder should be palpated, the ureter felt for, and the laxity or rigidity of the outlet noted. One should feel at the sides of the pubic arch for any muscular defects due to laceration of the levatores ani.

There are three special varieties of the "bimanual," known as the recto-abdominal, the recto-vagino-abdominal, and the vesico-vagino-abdominal.

The last is never employed now, not only because it gave little special information, but because of the risk to the urethra of laceration or over-dilatation. The recto-abdominal may be employed in virgin cases, but need not be specially described. We take up

The *recto-vagino-abdominal* bimanual. This is the one that gives the most information as to the pelvic organs. In parous or married women one always begins with the abdomino-vaginal bimanual, but its scope is somewhat limited by the roof of the vagina. Through the rectum the finger can pass not only higher up, but nearer to the ovaries; and the posterior surface of the uterus and broad ligaments, as well as the tubes, can be palpated more fully. If the patient is under the influence of an anæsthetic this method should always be employed. As, however, its use without anæsthetics is often distressing to the patient, we must only use it in those instances where it would not offend. When used in the unmarried an anæsthetic had better be given, unless the patient, when she is told that the bowel will also be examined, agrees to it, and is evidently not of a nervous or sensitive disposition. In married women this method presents fewer difficulties.

Method of performance.—The ordinary bimanual is first done as in a parous woman, and then, permission being granted, the fingers are withdrawn, cleansed, and then passed so that the index finger is in the vagina, the middle in the rectum, and the hand arranged as formerly described.[1] The bimanual is then carried out as already given. The blunder of withdrawing the rectal finger and passing it into the vagina without thorough cleansing should never be made. As a rule, patients dislike the use of the rectal finger in the bimanual, but its advantages are great.

We may note here that in difficult cases great help is given by the administration of chloroform, ether, or chloride of ethyl; thus obscure conditions are much more easily made out, and in almost all cases more exact information is obtained.

On suitable skeleton diagrams the relations of the organs and abnormal conditions can be mapped out, and a record thus provided.

V. INSTRUMENTAL EXAMINATION

This is necessary in a certain number of cases, and may comprise the use of the uterine sound, speculum, volsella, or tenaculum. The use of the curette, of tents, and metal dilators will be mentioned in their bearing on diagnosis, but their description and method of employment belong more properly to another section (*vide* p. 784).

The uterine sound.—The discovery of this instrument we owe almost entirely to Sir James Simpson, and it laid the foundation of Gynæcology as a science. It preceded the use of the bimanual, and was used long before the influence of micro-organisms in causing, or asepsis and antisepsis in preventing, disease was known. The risk of the use of an uncleansed sound, or of conveying micro-organisms from the external genitals (*e.g.* the bacillus coli communis, the gonococcus, putrefactive organisms) into the uterine cavity, and thence to tube and peritoneum, was not dreamt of, and thus the sound has had a somewhat chequered career in gynæcology, but is now considered as an instrument of the greatest value for diagnosis and treatment when used with proper precautions in appropriate cases.

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[1] In cases of infective vaginitis, especial care must be taken to avoid infecting the rectum by introducing the finger without effectual sterilisation (*vide* pp. 556 and 572).

The uterine sound of Sir James Simpson (Fig. 34), which after all is the best type of instrument, is a slender metal rod 12 inches long, curved forward in its uppermost 3 inches, and graduated in inches. It is now made entirely of metal. Two and a half inches from the point is a circular ridge showing the normal length of the uterine cavity, 2½ inches. Then come notches at 3½ inches, 4½ inches, and so on. There used to be a 1½-inch notch, but this weakened the instrument, and is not now provided. The surface of the handle is roughened on the side corresponding to the point. Professor Russell Simpson has modified the instrument by shortening it, squaring the handle, abolishing the 1½-inch notch, and on the whole he has improved it much, and made it more convenient for use (Fig. 35). As our present consulting rooms are constructed, there are not proper facilities for passing the sound safely. One cannot cleanse the genitals of a patient visiting us there, and thus the sound should only be passed at the patient's house or at the hospital, private or public, as the case may be.

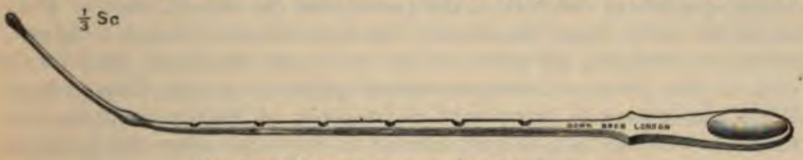

FIG. 34.—J. Y. Simpson's sound (handle modified).

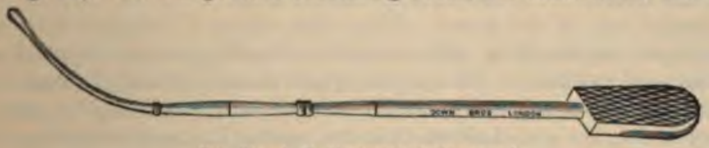

FIG. 35.—A. R. Simpson's uterine sound.

Precautions prior to passing the sound; Menstruation.—The patient's menstrual history must be accurately gone into, and the rule is not to pass the sound if the patient has missed one or more periods. It is best passed soon after a period, and in a married woman not too close on it. The greatest care must be taken as to those points, as not infrequently abortion has been brought about by its careless use.

Precautions as to patient.—It is advisable that she be cleansed externally, and also douched by the nurse; or she may herself take a sitz bath and use the douche.

The bimanual examination should be made with cleansed hands, and the diagnosis made as far as possible with it. It should be seen that the size of the uterus agrees with facts ascertained as to menstruation, and that no pregnancy exists.

Method of passage of sound.—The patient lies on her left side, and the examining hands are cleansed. The fingers of the right hand are passed into the vagina, the cervix touched, and the os externum felt.

The sound, sterilised by boiling, curved to the uterine curve, and with the point directed backwards, is passed with the left hand into the vagina, guided to the cervix, and passed into the cervical canal. If the uterus lie to the front, the handle is made to revolve through a big semicircle, thus bringing the point to the front; the handle is then carried back to the perineum, and the sound glides in to the proper depth. When the uterus is retroflexed the turning of the handle is unnecessary, and the handle is simply carried to the front after the point has entered the cervix. The patient may now be turned on her back, and with the sound maintained in position, the bimanual performed in certain cases as already described.

When the uterus is much flexed the sound is passed with difficulty, but the uterine axis may be straightened by means of traction on the posterior lip of the cervix with a volsella, and thus easier introduction secured. The following facts can be ascertained by means of the sound, viz. the mobility of the uterus, the length of the cavity, the direction of the axis of the uterus to the pelvis, presence of stenoses, roughnesses in the cavity, and so on. It is often said that one can feel polypi, projecting fibroids, etc., with the sound, but on such points the sound gives little information. One fails to note with the sound what may be easily felt with the finger.

Special uses of the sound.—When the uterus is blended with tubal distensions the sound is very valuable in enabling us to determine its position and relations. Then again, when we have blood effusions in the anterior fornix, or the rare cellulitis between cervix and bladder (anterior parametritis), the sound shows that the uterus is driven back and does not form part of the mass.

In the differential diagnosis of some ovarian and fibroid tumours, and in settling, when necessary, in which wall of the uterus a fibroid is in the main developing, the use of the sound is imperative. Here great care must be taken not to infect the uterine cavity, and thus to render any subsequent operation dangerous; *e.g.* if the supra-vaginal removal of the uterus becomes necessary. The differential diagnosis of polypi and inversion of uterus may also be helped by the use of the sound, but for this purpose the bimanual under chloroform is more useful.

Therapeutic uses of the sound are considered in a subsequent chapter.

Dangers of the sound.—These are at a minimum if proper precautions be observed, and are chiefly as follows:—

Perforation of uterine wall.—This may happen even in skilled hands, when the uterus is thin-walled and superinvoluted. It has often been done, and seems to be devoid of much risk. However, in superinvolution cases the use of the sound is unnecessary; these cases can be quite well diagnosed by the bimanual examination.

Sepsis or putrefactive infection may arise from want of the necessary antiseptic precautions. The normal genital tract is free from pathogenic or putrefactive organisms, but the external genitals may not be, unless specially cleansed. The vagina may become infected by pessaries, or special diseased conditions—abortion, gonorrhœa, etc.—when the use of the sound is evidently dangerous. The septic or putrefactive infection thus accidentally set up does not usually become general, but causes local inflammatory conditions—ovaritis, peritonitis, etc. One special risk is that of using the sound to replace forcibly the fixed retroflexed uterus, and here even fatal results have occurred.

Abortion can only be produced as the result of carelessness on the part of the examiner, such as his omitting to ask as to the period, or neglecting to perform the bimanual. In the early stages of pregnancy the sound has been passed inadvertently without causing abortion, and it seems in such cases to slip in between the reflexa and the opposite vera, which at that early stage are not blended.

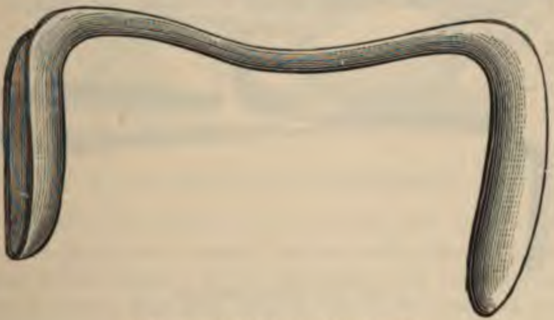

FIG. 36.—Duckbill speculum (Sims').

The Speculum.—We have already seen that in the genupectoral or Sims' posture (*vide* p. 42) the vagina distends with air if the vaginal entrance is opened up with the finger; and that if the posterior vaginal wall be hooked back the examiner can then look into the vaginal cavity and see the separated walls, the roof of the vagina, and the cervix uteri (portio). On these conditions are based the use of the most important speculum known as the Sims' or duckbill speculum. Two other specula, whose use is not based on these conditions, are sometimes employed, the tubular or Fergusson, and the bivalve or Cusco. We, therefore, describe these three; after these have been studied, their many modifications can be easily understood without further description.

The Sims' or duckbill speculum is shown in Fig. 36. It consists of two hollow spatulæ connected by an intermediate piece, whereby two specula of different sizes are provided. For operative purposes they have been variously and conveniently modified by Simon, Pozzi, Doyen, Auvard, and others.

Use of the Sims' speculum.—In case of mere diagnosis the patient is placed in the semi-prone posture, but in the lithotomy posture for operative purposes, or when examination is to be made under anæsthesia. In the Sims' posture the patient lies on her side with her left arm over the edge of the couch, which throws her somewhat on her breast ; the knees are well bent up, and the inner surface of the right knee touches the couch. The speculum has been sterilised and dried, and the blade chosen, smeared with vaseline or soap on its convex, but not on its concave aspect. The edges of the vaginal entrance (lateral) are separated with the index and middle fingers of the left hand, when the vagina will balloon, and the speculum point can be passed in and back. It should enter with the concave surface looking up, and then be turned so that the convex surface lies on the posterior vaginal wall, the concave or reflecting one looking forward. With the other blade grasped in the left fingers, traction is made backwards or downwards, when the anterior vaginal wall and cervix should be well seen. It is a common error to insert the blades too deeply. The posterior vaginal wall is covered by the blade, but if it requires inspection, it may be exposed by separating the lateral vaginal walls, in the lithotomy posture with spatulæ or the fingers. For merely viewing the walls of the vagina Fergusson's speculum is better, as we shall see. If the anterior vaginal wall bulges back, as it may do if voluminous or if the patient strains, it can be pressed forward with a sound or spatula.

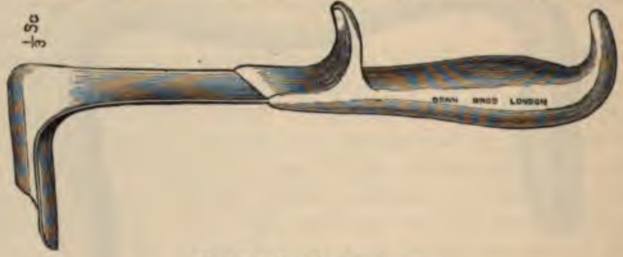

FIG. 37.—Pozzi's retractors.

The Sims' speculum gives the best view of the cervix; and splits, Nabothian follicles, catarrhal patches, hypertrophies, malignant changes, polypi, etc. can be well seen.

The speculum can also be held with the hand placed between the convexity of the free blade and the sacrum, aided by the thumb grasping the handle.

There are many modifications of Sims' speculum for operative purposes ; some conveniently consist only of one blade and handle, and moreover the blade may be shortened so as to admit of the uterus being drawn down ; or lengthened, so as to pass up into the vesico-uterine pouch as in vaginal hysterectomy. In Auvard's speculum the blade and handle meet at an acute angle, while the handle is loaded with lead, so that in the lithotomy posture it is self-retaining. If too heavy it may somewhat tear the perineum (Fig. 38).

Operative uses of the Sims' speculum are given in the various sections devoted to operations.

The Fergusson speculum has fallen into comparative disuse, but is valuable in a few special cases. It is merely a glass tube, of which there are varying sizes, with a trumpet end externally and a bevelled one internally. It has thus one wall shorter. Usually it is made of silvered glass with caoutchouc externally, of milk-glass or of metal. There are usually three to four sizes employed, according to whether the patient is virginal or parous (Fig. 39).

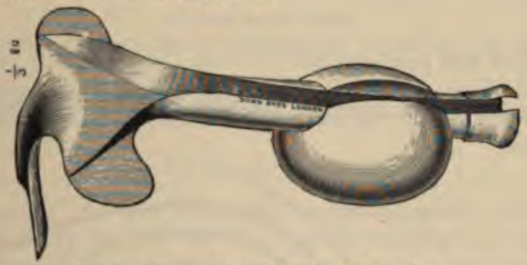

FIG. 38.—Auvard's operating douche speculum.

Method of Use.—The patient lies on her left side with the knees drawn up. The parts are exposed, the vaginal entrance opened up with the index and middle fingers of the left hand, and the instrument passed in, shorter wall above, it is then turned round so that the longer wall is posterior. The cervix may then be seen in the upper end; if not, the speculum is moved about until it is found. This speculum shows an unaltered cervix well; one can see Nabothian follicles and catarrhal patches well, also small polypi. As it is withdrawn the vaginal walls are well seen from above downwards. It shows cervical lacerations badly, does not show an enlarged cervix well, and for operative work is of no use. It may be used for certain methods of local treatment of the cervix; and is useful if liquid applications, such as carbolic acid or nitrate of silver, have to be made to a catarrhal patch or to the vaginal walls. The vaginal tamponnade may be done effectively with it, but the sound cannot be employed. On the whole it is seldom used. In virginal cases

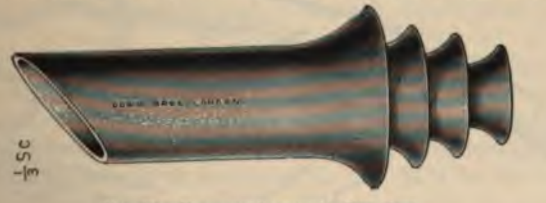

FIG. 39.—Fergusson's specula, four sizes.

a small size can be passed with the vagina ballooned in the genupectoral posture, and a good view thus obtained (Kelly).

The Cusco or bivalve speculum is a double-bladed speculum hinged a its external end and provided with a screw (Fig. 40). It is passed, afte cleansing and oiling, with the points closed, their transverse ends lyin antero-posteriorly at the vaginal entrance. It is then turned round, s that the blades lie front and back, the screw being external and posterior. The screw is now used to separate the points of the blades, and a good view of the vaginal roof can thus be obtained.

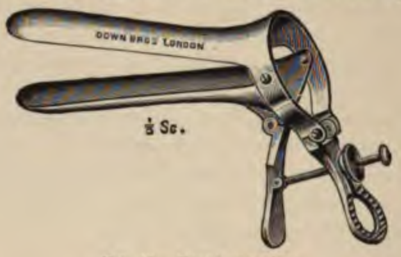

FIG. 40.—Cusco speculum.

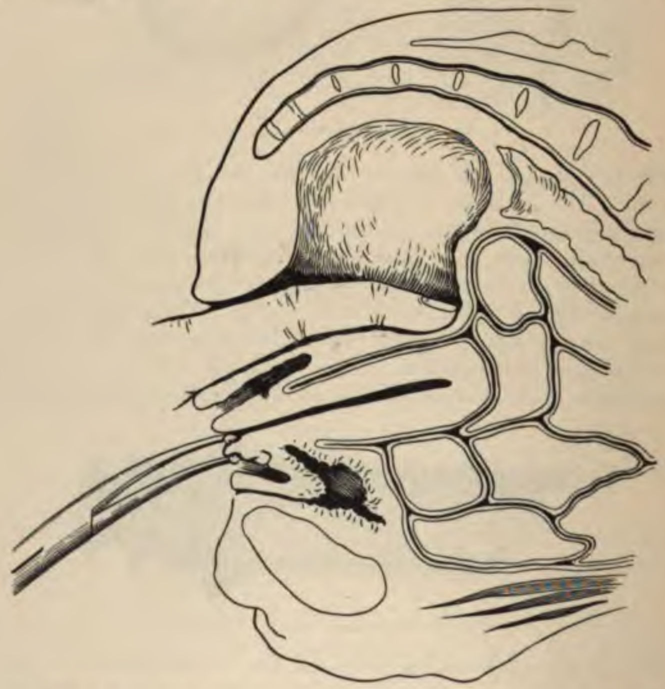

FIG. 41.—Uterus drawn down with volsella to aid in rectal exploration (Hart and Barbour).

It is not much used in this country, and has even a less extended scope than the Fergusson, except that in secondary hæmorrhage,—say, from the vaginal edges after a hysterectomy, it may be employed to expose the bleeding point, and it affords sufficient room to grasp it instrumentally.

For the consulting room Sims' speculum and Fergusson's are sufficient; for operative purposes some modified forms of Sims' are the only ones required.

Volsella; Tenacula.—We place them here in order of importance.

The *volsella* is merely a pair of toothed forceps provided, near or at the end where it is grasped, with a catch for fixation. Usually the volsella has a curve like the sound, but a straight or angled instrument is better.

For diagnosis the volsella is exceedingly useful, *e.g.* by approximating the flaps of a split cervix its real nature is demonstrated. When the uterus is well drawn down the pedicle of an ovarian tumour may be felt, and the side from which it is growing made out; but this is quite an unnecessary procedure. In examination with the Sims' speculum its use is valuable in exposing and steadying the cervix and adjacent parts. With it one can also estimate the mobility of the uterus, and make the uterus more accessible to the examining finger.

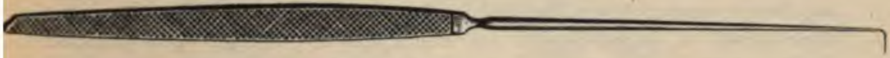

FIG. 42.—Sims' tenaculum.

It is in treatment, however, that the volsella is most useful, and in all vaginal operations and in some abdominal ones it is an indispensable instrument.

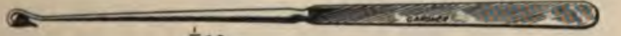

FIG. 43.—Kelly's shepherd-crook tenaculum for perineal operations.

The *tenaculum* is less useful than the volsella, and has much the same scope in diagnosis. In treatment it is superseded by the volsella. For perineal operations Kelly's shepherd's crook tenaculum is useful, especially in the modified Emmet's operation for relaxed vaginal orifice.

Method.—The volsella is employed to lay hold of the cervix after the Sims' speculum has been passed. The portion of the cervix covered by squamous epithelium should be grasped; sometimes the punctures bleed and require the pressure of a gauze tampon to check the oozing. The volsella, however, may be used by mere digital manipulation; and if a rectal examination be made at the same time the posterior wall of the uterus can be palpated, and the ovaries more easily felt (Fig. 41). The displacement of the uterus caused by the downward traction must be allowed for.

Contra-indications.—Inflammatory fixation, distended tubes, and advanced malignant disease are contra-indications to its use in diagnosis; but this, of course, does not apply to treatment.

VI. SIMPLE AND INSTRUMENTAL

RECTAL EXAMINATION

We have already considered the use of the rectal finger in the bimanual examination, and the inspection of anal tears, under inspection of external genitals. At present we take up digital and specular rectal examination.

Digital.—The anus should be looked at first, the patient lying on her left side, and external piles, venous piles, or protruding internal piles noted if present. For simple digital examination the finger is soaped, soap being pressed below the nail and base of nail, and then the index finger passed in, forwards, and the conditions felt as high up as possible. If the rectum is collapsed there may be some difficulty experienced; in such cases I have injected air with a Higginson's syringe, when the rectum balloons and its walls are very easily palpated. One feels quite easily the normal third sphincter folds, and can note piles, polypi, or malignant disease, whether low down, or in its more frequent position higher up near the pelvic brim. When the examination is finished the air will regurgitate through the nozzle of the syringe reintroduced for this purpose.

In parous women, Storer's method of eversion of the anal and rectal mucous membrane can be used. For this purpose the patient lies on her left side, and the anus being stretched laterally by the finger and thumb of the left hand placed externally at its margin, the index and middle fingers of the right hand are introduced into the vagina, and the palmar surfaces made to rest on the lower half of the posterior vaginal wall. Firm pressure is then made backwards and outwards through the anus. In this way the anal mucous membrane and that relaxed of the anterior rectal wall can be well seen, and the existence of fissures of the anus, polypi, and piles ascertained.

Specular examination.—The ordinary fenestrated speculum, or one folding laterally and with an external screw, may be used for inspection. More thorough and extensive methods are those specially perfected by Dr. Kelly of Baltimore. We have already seen that in the genupectoral or elevated lithotomy postures, when air is admitted by opening up the vaginal entrance (*i.e.* at the hymen or its remains), the vagina balloons. The same holds good for the bladder and rectum. In the case of the rectum it will be found that should the patient be placed in either of the postures already mentioned, and the anus opened up with the fingers so as to admit air, the rectum will balloon, and the ridges of the sphincter tertius become very evident; so that the finger now explores a cavity and feels any abnormal condition distinctly. Several years ago I adopted this posture for rectal examination, and used a Sims' speculum. Kelly has, however, made useful cylindrical specula, two short ones—sphincteroscope and proctoscope—and a longer one, sigmoidoscope. Each is provided with an obturator (*vide* Fig. 44). Suitable scoops are used to remove mucus and small fæcal masses; a conical sphincter dilator is not necessary.

Method.—The patient's bowels are thoroughly evacuated by aperients and enemas if necessary. Chloroform or ether is given, and the elevated lithotomy posture used, the patient's hips being raised 10 to 12 inches.

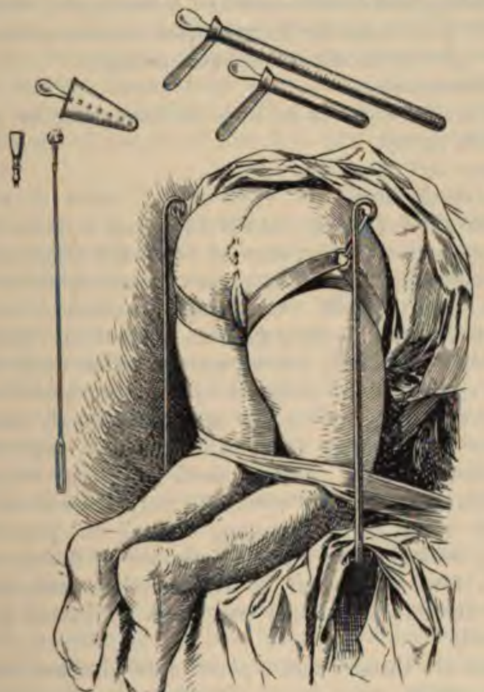

FIG. 44.—Postural examination of rectum, with instruments required (H. A. Kelly).

The speculum, with its obturator pressed on the palm of the introducing hand, is passed in the necessary direction, *i.e.* down and to the left, and the obturator withdrawn. Air then passes in. Light is reflected by the head mirror of the examiner, the electric lamp being placed over the pubes or sacrum according to the position of the patient. The parts near the lamp are protected from burning by a folded towel. A good view can now be obtained as the speculum is moved about; it may pass 12 inches. Operative work can be performed conveniently; and ulcerations, malignant disease, polypi, strictures, fistulæ, openings into pelvic abscesses, etc., can be easily seen.

VII. Additional Means of Examination

By the methods already described a very accurate knowledge of the abdominal and pelvic diseased conditions can be obtained, but in certain instances further investigation is necessary. This can be carried out by dilatation of the cervical canal, so that the finger may be passed in; by curetting the uterine cavity and examining microscopically the scrapings removed; by taking the blood count and leucocytosis; finally, the whole case may not be cleared up for diagnosis and treatment until exploratory abdominal or vaginal section has been performed.

We therefore consider—

1. Dilatation of the cervix so that the finger may be passed into the uterine cavity.
2. Dilatation and curetting.
3. Blood investigation.

1. *Dilatation of the cervix so that the finger may be passed into the uterine cavity.*—We may take a typical case to illustrate this point. A patient has profuse menorrhagia, but the uterus is not specially enlarged, and there is no fibroid in the wall. Curetting is performed; not much tissue is removed, but yet the bleeding goes on unchecked. Here the patient may refuse further treatment, but ultimately, either under the care of the practitioner or specialist who curetted, or perhaps, unfortunately for him, in the hands of another, a polypus is expelled through the cervical canal, and when removed a cure is effected. In such a case, where bleeding persists after curetting, the cervical canal should be dilated, the finger passed in, the cavity explored, when the polypus will be detected and removed. This is best done by passing with all due precautions a tupelo tent, previously soaked in an ethereal solution of iodoform (3 per cent), leaving this in for twenty-four hours, and then completing dilatation with Hegar's dilators; the finger may then be passed in, the polypus felt and removed.

Similar cases are those where a piece of decidua has been retained, as in incomplete abortion, or where, *e.g.*, Deciduoma malignum comes on after, say, hydatidiform mole, and can be recognised in the same way. Curetting in the last two cases may produce profuse hæmorrhage. The mere dilatation by means of metal or vulcanite dilators cannot in the unimpregnated uterus be carried out to such an extent as to admit the finger, and Bossi's dilator is not suitable in such cases. At least this is my own experience.

2. *Dilatation and Curetting.*—This is a very important procedure where malignant disease of the mucous membrane of the body is suspected. A tent is not necessary, as the dilatation to admit an ordinary curette is quite easily obtained with Hegar's dilators, or any of the modifications in metal. Probably the most convenient are those not straight, but with a uterine curve (*vide* p. 789).

The scrapings can be hardened for microscopical examination, and the necessary sections cut, stained, and examined.

3. *Blood investigation.*—It will be of great advantage for the clinician in special cases to have the blood count taken, and also the leucocyte count, so that any changes from the normal may be ascertained. The methods employed will not be given here—that belongs to the expert—but a few facts will be stated on the bearings of some abnormal blood conditions. Normally there are about 5,000,000 red blood corpuscles and 6000 to 10,000 white corpuscles per cb. mm. of human blood, so that their proportion is about 1 to 500. The simple blood count is of importance in anæmic cases requiring operation, *e.g.* bleeding fibroids. In these cases the hæmoglobin should also be estimated. In pernicious anæmia serious uterine hæmorrhage may come on, usually late in the case; then the negative results of local examination, combined with the special conditions of the blood found in pernicious anæmia, will clear up the diagnosis.

The "leucocyte count" is valuable in enabling us to determine whether pus is present in an exudation, cyst, or distended tube. For this purpose the specialist takes not only a quantitative count of the leucocytes, but a qualitative one also, and uses certain staining reagents which give in some of the leucocytes the colour change known as the Glycogen or Iodophile reaction. An increase in the leucocytes is known as Leucocytosis, diminution as Leucopenia. The important point is the determination of the presence of pus, and it is said that if the leucocytes are 20,000 to the cb. mm. or more, with a high percentage of the variety known as polymorphous (80 per cent and over), and the glycogen reaction is present, the existence of pus is certain. Below 20,000 one cannot be as sure, but here if the polymorphs are 70 to 80 per cent pus is very probably present.

In ovarian tumours, with or without twisted pedicle, and with no pus, leucocytosis may be present; and if the red blood corpuscles are diminished, it is suggestive of malignancy. Tuberculous pus causes no leucocytosis, and gonorrhœal pus but little. The leucocyte count should be repeated frequently where its interpretation is doubtful, and any increase or diminution in numbers noted. In septic cases, marked diminution after a rise, with other unfavourable symptoms, is very serious, while a rise to 20,000 and above probably denotes pus.

In chronic suppurative cases the pulse and temperature may give little evidence of the existence of pus, and therefore moderate leucocytosis is of importance. If there be purulent cavities with thick walls, hindering absorption, leucocytosis may not be present. In sepsis continuous leucocytosis is of good prognostic, and a fall is unfavourable.

In tubal cases, pyosalpinx from streptococci may have a leucocytosis of 20,000 and higher; the increase is much less in gonorrhœal tubes, and in hæmatosalpinx or extra-uterine gestation is not present at all.

(For methods see any good clinical Medicine Manual; also papers by Carmichael, *Jour. of Obst. and Gynæc. of the Brit. Empire*, iv. p. 268; v. p.

163; Gulland, *Brit. Med. Jour.* 1904; Dützmann, *Monatschrift für Geb. und Gynäk.* July 1903; Muir, article "Leucocytosis" in Green's *Encyclopædia Medica.*)

Bacteriological examination of discharges.—This is of importance in many cases. The usual organisms sought for are the gonococcus, pyogenic organisms, the tubercle bacillus, and the bacillus coli communis. The clinician can obtain the discharge, when necessary, through a disinfected speculum, by means of a platinum loop sterilised in a spirit flame; it is then smeared on a clean cover glass on which again another cover glass is laid and slid off. These are usually sent on to the bacteriologist for staining, or this is often done now by the house surgeon. The methods are not within the scope of this chapter. In special cases a sterilised gelatine tube should be inoculated so as to settle the nature of the organism by its form of growth.

Discharges may be taken from the vulva, openings of Bartholinian ducts (outer aspect of hymen), vaginal entrance, and higher up, cervical canal, uterine canal. Any discharge from the urethral orifice which may be obtained by pressure from above down over the anterior vaginal wall should be stained specially for gonococci, and it should be noted if the orifices of Skene's tubules are implicated.

Pus obtained from pelvic abscess and that in distended tubes should always be stained for organisms. Some operators have this done during the progress of an abdominal section where pus has been found, and drain when a pyogenic organism is present, but not in the case of the gonococcus or if the pus is sterile.

D. BERRY HART.

DISORDERS OF MENSTRUATION

THE line of demarcation between menstruation which conforms to the normal order, and menstruation which presents features sufficiently abnormal to be considered disordered, is very difficult to draw. Menstruation which would be normal in one woman, might in another be regarded as painful, or profuse, or scanty; even in the same subject, many deviations from the rule are perfectly consistent with health, and are not necessarily due to any local disease. In this article the various deviations from normal menstruation will be discussed; they are but symptoms, and when due to gross pathological lesions the description of these must be sought elsewhere. The prominent disorders are amenorrhœa, menorrhagia, and dysmenorrhœa; but before reaching a consideration of these, it will be well to discuss the questions of premature and protracted menstruation.

Premature menstruation. — Menstruation usually begins in the fifteenth year, and ends between forty-five and fifty; thus menstrual life normally lasts from thirty to thirty-five years. But menstruation occasionally sets in at a much earlier age. One case was recorded by Campbell, in which a girl had menstruated regularly every three weeks since birth. In many of these cases of precocious menstruation the general and sexual development is premature; the pubes become covered with hair, the mammæ enlarge, and both the external and internal generative organs undergo rapid development.

I have tabulated the recorded cases under the following heads; and, where the case seemed one of more outstanding peculiarity, I have shortly epitomised its history :—

1. Precocious menstruation with an early appearance of the external manifestations of puberty.
2. Precocious sexual development without menstruation.
3. Menstruation previous to development of the sexual organs.
4. Early conception and pregnancy.
5. Premature sexual development associated with tumours of the generative organs.

1. One of the most striking cases illustrative of the first group is the oft-quoted one of De Beau, to the record of which he considered it advisable to append the signatures of four physicians, a mayor, and a British consul.

The history is as follows :—"Matilda H. was born on the 31st December 1829. She came into the world with her mammæ perfectly formed, and the mons veneris covered with hairs, as much as a girl between thirteen and fourteen years old. When precisely three years old the catamenia made their appearance, and have continued to appear regularly every month until the present time, and as copious as any woman might have them, each period taking four days. . . . Her mammæ are now of the size of a full-grown orange; and the dimensions of the pelvis are, in my opinion, such as to enable her to bear children when eight years old, and very likely sooner."

In Campbell's case (2) the catamenia set in a few days after birth, and occurred regularly at periods of three weeks and two or three days. This order continued until the patient died at the age of four years. Her appearance was that of a girl of ten or eleven, the mammæ and external genitals having the appearances proper to puberty. The development of the pelvis and of all the deep-seated genitals was found at the autopsy to be very considerable.

R. B. Smart gives a table of eight recorded cases, and describes in full detail a case which came under his own observation, with two accompanying photographs of the patient. The catamenia in this girl appeared at three years and six months, and the hair on the pubes shortly antecedent to that.

Bouchart narrates the history of a girl, N. O., and the appearance she presented at the age of four years. She had been born with the breasts notably enlarged, she began to menstruate at the age of twenty-two months, and at the time of examination she presented the appearance of puberty as regards her breasts and genitals. Menstruation in her case was very regular in its recurrence, it lasted four to six days, and was in quantity equal to that of an adult.

Harris classifies precocious menstruation in two varieties: 1st, that occurring during infancy; 2nd, that occurring between the ages of seven and thirteen years. He records the case of a girl who came under his own observation, in whom menstruation appeared at the age of nine and a half years, and in whom the other evidences of puberty manifested themselves.

C. E. Harle records the result of a post-mortem examination on a child who had begun to menstruate at the age of five months; the menstruation returned regularly till the fourteenth month, when the child died of diarrhœa. The pudenda were large and clothed with hair; the uterus was large, the os patent and the lips congested, the vessels of the broad ligament were injected, and both ovaries were cystic.

The other cases I have noted under this category are the following:—

Author.	Menstruation began at age of	External Appearances of Puberty.
Astley Cooper in *Med.-Chir. Trans.* 1813.	3 years.	In breasts, axillæ, and on pubes.
Thomas Embling in *Lancet*, 1848.	2 years.	Mammæ and pubes.
Aveling in *Lancet*, 1866, gives a reference list of sixteen cases by different observers.		
Prochownick in *Arch. für. Gynack.* 1881.	1 year.	In breasts, axillæ, and on pubes. Internal organs not enlarged.
Berry in *Medical Press* for 1882.	5 years and 4 months.	Breasts and genitals.
A. van Denver in *Amer. Journal of Obstet.* 1883.	4 months.	Mammæ greatly enlarged.
Four of the following cases are cited by Pozzi in his *Gynécologie*:—		
Cabade in *Gaz. méd. de Paris*, 1883.	8 months.	Rapid development.
Wallent in *Dissert. Inaug.*, Breslau, 1886.	1 year and 3 months.	
Casati in *Il. Raccoglitore*, 1886.	6 years.	Rectal examination, "*utérus pubère.*"
Diamant in *Intern. klin. Rundschau*, 1888.	6 years.	Extl. genitals.
Jago in *New York Med. Journ.* 1889.	2 years.	Extl. genitals.

2. The indications of a sexual precocity, manifested by the outward signs on the breasts and pudenda, but unaccompanied by a menstrual discharge is unusual. Few instances of this character have been noted, but that described by William Cook is distinctive enough.

3. Menstruation occurring without any change in the genitals is not so unusual as the preceding, but it is rare for a child to have the catamenia established for a period of years without other associated phenomena presenting themselves.

Pozzi cited Bernard's case of a girl who menstruated regularly from birth up to the age of twelve years without any development of her genital organs.

In the same class may be included the cases noted by the following authors :—

Prof. Clifford Allbutt reports a case where the menstrual discharge occurred periodically until the youthful patient died apparently of exhaustion.

Clarence Harding reports that in a family of two daughters both suffered for a time from a periodic discharge, hæmorrhagic in character, in the elder of whom the discharge vanished until puberty was established, when it recurred.

4. Many remarkable instances of early pregnancy have been put on record by trustworthy authorities; the majority of those in this country have occurred after the age of twelve. There is, however, in Continental literature no great scarcity of reports of pregnancies at a much earlier age.

The following table of cases which I have collected from various sources has been arranged in order of age. The majority of the records bear evidence of being trustworthy :—

Author.	Reference.	Development.	Menstruation.	Impregnation.	Delivery.	State of Child.
Müller	*Cyclop. of Obst. and Gynec.*	Excessively at birth.	2nd year.	8 years.	Instrumental, 8-9 months	Dead.
Schmidt	*Essais Historiques*, 1779.	Sexual organs developed.	2nd year.	..	8 years and 10 months.	Full term, dead.
Bodd	..	..	1 year irregular, 7 years regular.	..	8 years and 10½ months.	..
Molitor	..	Hair on pubes at birth.	4th year.	8 years and 8 months.	Premature, 5th month.	Fœtus — 3 months'.
Dodd	*Lancet*, 1881.	Pubes and axilla covered with hair.	12 months.	8 years and 10 months.	..	Weighed 7 lbs.
Rowlett	*Trans. Med. Jour.*	A few weeks after birth.	12 months.	9 years and 3 months.	10 years.	7¾ lbs.
Bayliss	*Brit. Med. and Surg. Jour.* 1846.	..	9 years and 10 months.	..	10 years and 8 months.	Alive, weighed 8 lbs.
Robertson	*Midwifery.*	..	..	12th year.	12 years and a few months.	..
Smith	*Lond. Med. Gazette*, 1848.	No history.	10 years.	11 years.	12½ years.	Fully developed.
May	*Lancet*, 1880.		Once before conception.	..	13 years.	Well developed.
Heywood Smith	*Brit. Med. Jour.* 1881.	..	12 years and 6 months.	12 years and 8 months.	13 years and 4 months.	..
Wilson	*Edin. Med. Jour.* 1861.	No precocity.	..	12 years and 9 months.	13 years and 6 months.	Full grown.
Chapman	*Assoc. Med. Jour.* 1856.	..	..	13 years and 1 month.	13 years and 10 months.	Full grown.

5. It has been asserted that among the causes tending to produce changes in the sexual apparatus peculiar to puberty we should include neoplasms affecting or in relation with the internal generative organs. This

would appear, however, to be far from the usual rule, and to be rather the exception. In order to ascertain the frequency of this occurrence, I have examined the records of twenty-six laparotomies performed on children under puberty; and in one case only did there seem to have been signs so marked as to arrest the attention of the operator and induce him to give a description of the child's appearance. On this one occasion the narrator and operator was Mr. R. Clement Lucas:—

The child was aged seven, and had had a hæmorrhagic discharge from the vagina, which occurred whilst she remained in hospital. The mammæ were firm, and about the size of oranges; the mons veneris was of unusual elevation, and covered with hair about one inch in length. There was a tumour of the right ovary, which was removed, and the child made a good recovery. The vaginal discharge disappeared, and the mammary prominence subsided before she left the hospital.

Premature menstruation is in a large measure hereditary; but a more important factor seems to be immoral associations. Neglected children, by coming in contact with vicious girls older than themselves, frequently have their attention prematurely directed to the sexual organs. Bad habits, the result of irritation produced by ascarides in the rectum, want of cleanliness, or caseous secretions about the clitoris, may also lead to a precocious development. Over-excitability of the brain has also been considered by some authors as a factor in the production of a too early puberty.

The management of such cases consists in removing the cause as far as possible. Masturbation should be prevented by careful supervision of the child and by the relief of local irritations. General rest and tonic treatment, with removal from nervous excitement, should be advised.

Protracted menstruation.—A history of this condition is to be received with caution. Women past the menopause are apt to consider any intermittent or irregular discharge as a continuation of the menses. Such a hæmorrhagic discharge is, however, in most cases due to the existence of some distinct pathological lesion; such as senile uterine catarrh, polypus, fibroma, or even cancer; it is sometimes associated with a gouty diathesis. Nevertheless, some authentic cases have been recorded in which normal menstruation continued even till the fifty-seventh year. But it may be taken as an ascertained fact that, so far as normal menstruation with accompanying ovulation is concerned, authentic cases of pregnancy are not recorded after the age of fifty-two, or of fifty-four at the outside. It is safe, therefore, to presume that these ages indicate the extreme limit of normal menstruation accompanied by fertility.

AMENORRHŒA, or absence of the menstrual discharge, is primary when the patient has never menstruated at all; secondary when menstruation has previously taken place. It exists as the normal condition during pregnancy and lactation.

Primary amenorrhœa.—(*a*) *Primary permanent amenorrhœa.*—The most marked cases are those in which the ovaries, or uterus, or both, are altogether absent, or remain in a rudimentary condition, while the external genitals are normally formed. The girl's sexual development ceases, and her characteristics, physically and mentally, tend to the masculine, or at least to a mixed type. The cause is absolutely unknown. Heredity, or interruption of normal embryonic development, or interference with it, cannot be accepted as satisfactory explanations. Nothing can be done to relieve the condition.

Cases of this kind may be grouped in two classes: one is characterised by complete arrest of sexual development. The mammæ are undeveloped, the pubes is bare (which is specially characteristic), and the uterus and ovaries are found on vaginal examination to be rudimentary, if not altogether absent. The second class consists of cases of women usually of "masculine" habits—acrobats, for example; in them the mammæ are well developed, the upper lip is hirsute, there is a copious development of hair over the pubes, and on vaginal examination the uterus and ovaries are found, if not normal in size, very nearly approximating to the normal. Such cases seem to be accounted for by muscular training being pressed from early childhood to such an extent as to interfere with the usual function of the reproductive organs.

(*b*) *Primary temporary amenorrhœa* may be due to chlorosis occurring in girls under the age of puberty. In this condition the vascular system is at fault; not only are the walls of the vessels themselves imperfect, but the blood contains fewer red corpuscles than is normal, and they are especially deficient in hæmoglobin. In such cases, however, there is a tendency to plumpness from undue development of adipose and cellular tissues. The general appearances and symptoms of such patients are well known. Menstruation occurs later than normal, and when it does set in, the flow is scanty and of short duration; the intermenstrual periods also are longer.

The treatment is the ordinary treatment of chlorosis: it consists in the administration of arsenic and iron; rest at first and exercise later; careful non-fattening diet and saline purgatives. In many cases the digestion is also at fault, and has to be rectified by the usual stomachic remedies. If circumstances permit, much advantage may be derived from a course of the waters at such places as Tarasp and Schwalbach.

(*c*) *Delayed puberty.*—Here the general and sexual development are complete, and yet the girl fails to menstruate. These cases are sometimes accounted for by the suggestion that the "nutritive forces have been directed towards the general organisation." Some such girls have often too much physical labour. Thus among the poor, who do a great deal of manual outdoor work at an early age, menstruation is often delayed. On the other hand, brain-workers often exhibit the same symptom; by overwork of the higher functions the nutritive and reproductive systems are thrown out of balance. Diet also is an important factor;

an excess of meat in the diet, as is so often found in upper classes, leading to an earlier onset.

The management of such cases is easy, and attended as a rule by satisfactory results. Change of occupation, rest for the body if the physical strength has been overtaxed, and rest for the mind when its faculties have been strained, will generally effect a cure.

Secondary amenorrhœa.—This may be the result of various pathological conditions. Thus it may be due to such constitutional derangement as results from anæmia, chlorosis, diabetes, Bright's disease, malaria, cancerous cachexia, tuberculosis, acute illnesses, and fever. In the same way acute or chronic surgical affections may be potent in producing amenorrhœa. Some authors lay much stress upon the amenorrhœa which is the occasional result of syphilis. This symptom, however, is no doubt due simply to the anæmic condition which is associated with the disease.

The suppression of the menses that occurs in young obese women is to be accounted for in the same way.

The influence of the nervous system is distinctly a factor in the production of amenorrhœa. Thus a sudden fright has not infrequently been known to cause a temporary suppression of the menstrual flow—as when an unmarried woman fears that she may be pregnant; on the other hand, it must not be forgotten that in a few cases a stimulating rather than an inhibitory action has been known to follow a sudden emotion, causing menstruation to set in. Again, amenorrhœa due to the influence of the nervous system is shown in the insane, and in prisoners,—a change which is due no doubt to the mental depression consequent upon seclusion. Chills are very commonly responsible for the cessation of the menstrual flow, and in such cases the influence may be conducted through the vasomotor nerves.

The amenorrhœa of pseudo-pregnancy occurring in the newly married, in those who have been leading irregular lives, and in those who are reaching the menopause, is well known, and is to be accounted for by an influence acting through the nervous system. Pozzi attributes it to "auto-suggestion."

Amenorrhœa often occurs in young girls who are sent to Germany or France to school, when the change of climate and diet appears to lead to this symptom. Similarly, a long sea-voyage may produce such a condition.

The local diseases which cause suppression are many. Atrophy of the uterus commonly leads to it, and this may be the result of superinvolution, prolonged lactation, or tuberculosis. So, too, many cases are recorded in which an early menopause has occurred without apparent reason: menstruation gradually or suddenly ceases, and on examination the internal generative organs are found in the atrophic state of a normal climacteric.

Tumour of the ovary may not interfere with menstruation in any way; but occasionally, when both ovaries are completely destroyed by cystic or other degeneration, menstruation ceases. If but one ovary be affected, menstruation may go on fairly regularly, as it may when the ovaries are the seat of inflammatory changes. In the early stage of inflammation the tendency is rather to menorrhagia; but in the later sclerotic stage amenorrhœa does occasionally, though rarely, occur.

Amenorrhœa due to atresia of the cervix, vagina, or hymen, whether congenital or acquired, is a condition which demands special attention. This is not the place in which to discuss the deformities producing the conditions known as hæmatometra and hæmatocolpos, in each of which menstruation, though not suppressed, is retained, owing to occlusion of some portion of the genital canal. The outflow is thus obstructed, and the uterus or vagina, as the case may be, is converted into a retention cyst. So long as the blood is free of bacilli, it remains a simple blood collection, but should it become infected with micro-organisms, the fluid becomes purulent.

Causes.—When the condition is congenital, it is brought about by an occlusion of the cervix, vagina, or hymen. The occlusion of the hymen is the commonest variety. In this case the vagina becomes distended with blood to a greater or less extent, depending upon the length of time that the menstrual function has been developed. The blood accumulates, the vagina gets more and more distended until it forms a tumour of very great dimensions, filling the pelvis and pushing the uterus upwards. Sometimes the cervix, and afterwards the uterus, become filled with blood, and occasionally there is a reflux of blood from the uterus into the Fallopian tubes, which become distended and sausage-shaped.

In atresia of the vagina the obstruction is most marked at the lower third of the vagina, and a similar sequence of events takes place. Atresia of the whole vagina is rare, and is usually associated with imperfect development of the uterus itself.

Atresia of the cervix may occur at the internal or external os, and occasionally affects the whole canal. In this condition the mucus and blood accumulate in large quantities, sometimes making the walls of the uterus very thin, but occasionally causing an eccentric hypertrophy of its walls. In such cases there is apt to be well-marked hæmatosalpinx due not only to the regurgitation of blood from the uterus, but also to bleeding from the mucous membrane of the uterus itself.

With regard to acquired atresia, this variety most commonly occurs at the cervix, the result of some operation, inflammation, the application of caustics, or some sloughing after parturition. Atresia of the vagina following labour is occasionally met with. It is due to sloughing from pressure during labour, followed by cicatrical contraction.

Symptoms.—In the congenital variety there are no symptoms until after puberty. Attention is drawn to the fact that though there is complete amenorrhœa, yet, as each menstrual period occurs, there is pain of a colicky, cramp-like nature, and bearing-down efforts without any escape of blood. This returns month by month; but there is no external manifestation of hæmorrhage. Sooner or later in the hypogastrium a soft, fluctuating, elastic tumour is felt. Occasionally contractions are felt over it, and sometimes a bruit is heard. The swelling may be the uterus or the distended vagina. When the Fallopian tubes are distended, either, or both, will be felt like sausage-shaped tumours on one or both sides of the swelling. When, owing to the presence of micro-organisms, the fluid has become purulent, there will be the usual accompaniment of rigors, fever, rapid pulse, and emaciation. When the occlusion is due to an imperfect hymen, the hymen will be thick, rigid, and vascular, and it will be found discoloured and bulging between the lips of the vulva.

The appearance of the fluid is very characteristic, being of a dark treacly appearance, very thick, and under the microscope presenting broken-down blood corpuscles, and also blood pigment and epithelial cells.

In regard to the acquired variety, the history of the case in addition to the physical signs will be sufficiently clear.

Diagnosis.—The diagnosis ought always to be made under anæsthesia. The bowels should be well emptied, and the bladder catheterised, and a rectal examination should in all cases be carefully carried out. In most cases where the obstruction is hymeneal, the bulging will be obvious, and even where the lower portion of the vagina is involved as well, the bulging will be distinct. Obviously, the history will go a great way to elucidate the facts. The absence of menstruation, the periodic attacks of discomfort, and the presence of a supra-pubic tumour of greater or less dimensions will greatly facilitate diagnosis; or should the condition be acquired, the history of a severe labour or a gynæcological operation, and the subsequent amenorrhœa, menstrual colic, and dyspareunia will give the necessary indications. In cases of hæmatometra from atresia of the internal os, with a normal cervix, the differential diagnosis will lie between pregnancy, fibroma, cancer of the fundus, and hæmatometra.

The physical examination must always be conducted with great care, as, in cases where the Fallopian tubes are distended, pressure may cause rupture, and so bring about a fatal peritonitis. A rectal examination is always of the utmost value, as it may reveal a fluctuating sac above the atresia.

Prognosis.—The prognosis is always serious. Of course it is less serious in atresia of the hymen than in that of the vagina. The main dangers are the rupture of the sac or the occurrence of simple or septic peritonitis. The prognosis is gravest when the Fallopian tubes are most distended. If left to themselves these accumulations of blood are very serious. Spontaneous evacuation seldom does much good, it only offers temporary relief. The retention returns, aggravated by suppuration. Spontaneous perforation is equally unsatisfactory. The condition, uninterfered with, is always a grave one.

Treatment.—In all cases of retention it is of the utmost importance that the condition of the tubes should be examined first of all by means of a careful rectal and abdominal palpation. If they are dilated, in all probability the safest and best plan is to open the abdomen and remove the tubes first of all by abdominal section, and afterwards to proceed to the emptying of the sac. If the tubes, however, are not involved, and the accumulation is due to occlusion of the hymen, or atresia of the lower part of the vagina, then it is usually enough to make a crucial incision in the hymen, or, if the vagina be affected as well, a careful dissection of the tissues; and to allow the fluid to escape very slowly, without exerting any pressure. The canal should then be irrigated with a weak antiseptic solution, until it is perfectly clean. Thereafter the cavity ought to be packed with iodoform gauze, which should be changed every ten or twelve hours, and each time the packing is renewed the canal should be irrigated. The importance of careful antiseptic precautions cannot be over-estimated, as the danger of septic infection is always considerable.

In cases of atresia of the cervix the obstruction must be overcome by bougies or by incision in the cervix, and the uterine cavity thereafter irrigated and packed.

Influence of removal of both ovaries upon menstruation.—There are two classes of cases to be considered: first, those in which the excised ovaries were the seat of tumours, cystic, papillary, or solid; and, secondly, those in which the ovaries on removal were either healthy, or were removed on account of some inflammatory or slightly cystic condition, or on account of dysmenorrhœa. As regards the first class, it is often difficult to state for certain that the whole of the ovary has been removed; a small portion may be left in the pedicle, and this may be quite sufficient to lead to the continuance of menstruation. As regards the second class, it has been affirmed by Lusk that in the great majority of cases (86 per cent) menstruation ceases, if not at once, at least within a year of the removal of the ovaries. In those cases in which it does not cease some authors have supposed the existence of a supplementary ovary; but it is probably an automatic ebb and flow produced through the influence of the nervous system. Another factor in the production of this continuation of menstruation after oophorectomy is the condition of the uterine mucosa. This is frequently in a congested, if not in an inflammatory condition, and for this reason some operators advise that curettage of the uterus should be performed in all cases after the removal of the appendages. Czempin considers it possible that the cicatrisation following oophorectomy may compress the veins, and so keep up a passive congestion and a continuance of the monthly flow.

Oophorectomy not only leads to local disturbances — chiefly to amenorrhœa—but is apt to lead to general physical changes which are attributable to the loss of ovarian internal secretions, now generally considered to be a factor of considerable importance. There is an increased plumpness of the body, although the mammæ generally atrophy;

and there is frequently a change of disposition, which often becomes more placid.

If the Fallopian tubes alone are removed, the ovaries being healthy, these local and general changes do not occur.

My own experience in cases of removal of the ovaries for inflammatory conditions, tubal enlargements, and minor ovarian disorders, does not coincide with that of Lusk; I have found that a much larger proportion of women continue to menstruate regularly for years after the ovaries have been removed, and that the only difference in these patients is that the menopause is anticipated by some years, and that, in most of them, though by no means in all, menstruation, if it continue, is without pain.

In a few cases of this kind, especially those in which the operation was undertaken for the cure of fibroids, I have found that the hæmorrhage has sometimes been increased.

Though it is obviously impossible to follow every case to a definite issue, the following is my experience in the matter:—

In Removal of the Ovaries and Tubes for Minor Affections
my percentage is approximately as follows:—

In 40 menstruation ceased.
In 30 " continued irregularly for years.
In 20 " " regularly.
In 10 " recurred at long intervals.

Symptoms of amenorrhœa.—Besides the absence of the periodic flow, which is, of course, the chief symptom, numerous constitutional symptoms are observed as the accompaniments of amenorrhœa. Thus hysteria is frequently an important and serious complication; while minor sensory disturbances, such as amblyopia and tinnitus, may be reflex or the result of anæmia. Paresis has also been known to occur, due no doubt to the accompanying hysterical condition.

Vicarious menstruation.—Many cases are recorded in which the function of menstruation has been taken up by other organs of the body, the condition being known as vicarious menstruation. Jones reports a most remarkable case in which, when menstruation was suddenly suppressed by a chill, the woman for five months thereafter had amenorrhœa, but regularly in each of these months she had for thirty-six hours an abundant flow of milk from the breasts. In another case the catamenia were replaced by a profuse diarrhœa which lasted for three days every month; and in yet another a periodic leucorrhœa was the only indication of the menstrual function.

Besides these extraordinary cases, many instances are recorded of hæmorrhages from the respiratory or alimentary tracts being substituted for the normal uterine discharge. More rarely bleeding from the ear has occurred, and in one or two cases subcutaneous hæmorrhages have been observed; or bleeding from a raw surface, such as an ulcer, has taken place regularly every month.

Treatment of amenorrhœa.—This naturally varies very much according to the cause. In many cases it is quite useless to administer drugs that are supposed to act directly upon the function of menstruation, without first carefully considering whether some general constitutional condition may not account for the suppression. No doubt, in some instances, such drugs as rue, savin, and saffron have succeeded in restoring the function; but this result has occurred in cases in which the amenorrhœa was simply due to a chill or violent emotion. When it is the result of anæmia, chlorosis, syphilis, or tuberculosis, these diseases call for treatment, and the pelvic organs require no special attention. In amenorrhœa from chlorosis—so common in young girls—treatment by iron and arsenic, baths and saline purgatives, is followed by excellent results. Many other remedies are attended with equally good results. Manganese is considered by some physicians to be as useful as iron in the treatment of anæmia; it is also supposed to have a special emmenagogue action: I have not found it nearly so satisfactory as some forms of iron. Judicious physical exercise and change of air are also important in the treatment of amenorrhœa.

As regards local treatment, this in many cases is of no avail. When the organs have become atrophied from any cause, no local treatment seems to have much effect in ameliorating the condition. Electricity has been advocated by many physicians, and in the hands of some I have no doubt it has been occasionally successful; but my own experience of it has not been very encouraging.

In those instances in which the suppression of menses is complicated by the patient's rapidly growing obesity, the indication is clear; and careful dieting, with baths and exercise, will generally effect a cure. Stimulation of the uterine mucosa by gentle curettage may sometimes be useful in securing a return of the menstrual flow.

In the amenorrhœa which results from a premature menopause due to the removal of the ovaries, the ordinary symptoms of the climacteric period —lumbar pains, flushings, giddiness, and various vaso-motor troubles—usually appear. In such cases, besides the general treatment by bromides and tonics, the patient occasionally derives benefit from scarification of the cervix every month, so as to obtain a slight local bleeding and relief of congestion. Relief of the general symptoms is frequently obtained by the administration of ovarian extract.

The intra-uterine zinc and copper stem pessaries, so much advocated long ago by Sir James Simpson, are, I think, devoid of any galvanic action whatever, yet they evidently do good in some cases, as does scarification of the cervix, by permitting a temporary flow and giving a temporary relief.

SCANTY MENSTRUATION.—This condition is due to causes very similar to those of amenorrhœa. It may be either primary or acquired. If primary it remains constitutional through life; if acquired, it is as the result of some intercurrent pathological condition, such as those referred to in the description of amenorrhœa proper.

Here, however, it must not be forgotten that scanty menstruation, like menorrhagia, is merely a relative term; menstruation is abnormal when it extends beyond six days in the one direction, or is reduced to two in the other. It must also be borne in mind that, before any opinion can be given, the menstrual habit of the individual must be accurately determined.

The treatment is to be on lines similar to those laid down under the head of amenorrhœa.

In a certain class of cases, inflammation which in the first stage tends to cause menorrhagia, at a later stage induces amenorrhœa. Such cases are best illustrated by endometritis. As is well known, the symptom of acute and subacute endometritis is menorrhagia; but when the condition has become extremely chronic, when the mucous membrane has become thin, the vessels shrunk, and the fibrous tissue greatly increased, scanty menstruation is a well-marked symptom. This condition has also been frequently observed in what is known as *Parametritis atrophicans*, in which, by the contraction of an inflammatory deposit in the broad ligament, the arterial supply to the uterus has been so curtailed that scanty menstruation or even amenorrhœa has been the natural result.

MENORRHAGIA AND METRORRHAGIA.—By the term menorrhagia is meant an excess of discharge occurring at the time of the usual menstrual period; by metrorrhagia, hæmorrhage from the uterus not coincident with a menstrual epoch. In considering these two symptoms it is necessary, in the first place, to deal with the difficulty of deciding what amount of hæmorrhage at the monthly period is to be considered as excessive; and in the second place, as all bleeding from the vulva, apart from the menstrual flow, might at first be considered as metrorrhagia, the causes of bleedings which might wrongly be confused with metrorrhagia must be enumerated, in order that we may eliminate them, and find ourselves free to deal with the subject systematically.

Menorrhagia occurs as an excessive flow of blood during the normal number of days which constitute a period, or as an ordinary flow extending over an excessive number of days. Our only means of comparison is to ascertain if the function differs from the patient's usual habit, and, moreover, if it is affecting her general health.

In the case of delicate anæmic girls, barely able to sustain the nutrition of their own bodies, even an entire absence of menstrual discharge is not necessarily to be looked upon as an evil; we may find that on the restoration of health by tonic and restorative treatment the periodic discharge of blood will take place without reducing the bodily powers: on the other hand, there are women who normally menstruate for eight or ten days at each period without suffering any inconvenience or derangement of the general health. Thus, in a woman who has menstruated before, it is only by a consideration of her menstrual habit, and by making due allowance for climatic and other influences, that we can determine the standard by which her menstruation is to be judged.

At the same time it is well, for general purposes, to have an arbitrary limit; and this we can roughly assign by observing the average time occupied by the period in a considerable number of women—a matter already discussed under amenorrhœa; we should thus be led to consider the function to be excessive if it lasted longer than six days; and the actual amount of blood lost may be estimated in terms of the diapers employed—ten to fifteen being looked upon as a fair average number for each period.

The term metrorrhagia is held to imply only bleedings from the uterus and cervix uteri: on the one hand, it is obviously impossible in a gynæcological treatise to consider at length hæmorrhages occurring in connection with pregnancy; and, on the other hand, the discussion of bleedings from the vagina and vulva belong to other chapters. It is only necessary in this place, in order to facilitate reference, that these various sources of hæmorrhage should be mentioned.

Bleeding associated with abortion, myxomatous degeneration of the chorion, placenta prævia, separation of the placenta ("Accidental Hæmorrhage"), retained placenta or membranes, inertia of the uterus, and inversion of the uterus, is fully described in works on Obstetrics.

Of sources of hæmorrhage which may be mistaken for menorrhagia we may simply mention vaginitis with ulcerations or other lesions of the vagina; injuries of the hymen and vulva; and the rare occurrence of rupture of varicose veins in the pudenda, associated especially with pregnancy.

We have next to consider a class of causes which are independent of the special function of the uterus, but may produce bleeding from it as from any other mucous membrane of the body. These causes depend for the most part on alteration in the condition of the blood. For example, a woman of the hæmorrhagic diathesis will bleed much more profusely at her menstrual epoch than other women, as would be the case with her in epistaxis, or on the breach of any other surface. Besides, hæmophilia, scorbutus, and purpura act in this way; and although chlorosis, as we have found above, tends rather to produce a condition of amenorrhœa with leucorrhœa, yet in some cases it leads to menorrhagia and metrorrhagia. It may be that in these cases the condition of the blood and the state of the vessels are sufficient to account for the hæmorrhage; but some local condition is often found along with these, such as a small fibroid tumour, or a congested condition of the uterine mucosa due to displacements, which as well as the general condition require treatment. These cases are amongst the most difficult to treat, because they interact in such a way as to produce a "vicious pathological circle"—the drain on the system by the hæmorrhage tending to aggravate the very systemic condition which in its turn leads to the menorrhagia.

Many other general conditions dispose to menorrhagia and metrorrhagia, such as long-continued mental depression, hysteria, and other nervous disturbances; deranged states of the system due to too luxurious and too sedentary habits of life; residence in tropical climates, or in damp, unhealthy situations; malaria; tubercle; the acute exanthems ("uterine epistaxis" associated with typhoid fever); lead and phosphorus poisoning, and Bright's disease.

Hæmorrhage, again, may be associated with disorders of the circulation. High venous pressure, especially as the result of mitral incompetence or stenosis; or a congested condition of the vessels of the pelvis, the result of pressure exerted on the veins of the portal system by new growths, are apt to produce bleeding, which, like the epistaxis that sometimes appears to save a patient from a cerebral hæmorrhage, may be looked upon as a relief of congestion. In most cases of the kind, however, we may suspect the presence of a predisposing local condition in a diseased state of the uterine mucous membrane.

Cirrhosis of the liver and kidneys is a cause belonging to the same class; and when the cirrhosis itself is due to alcoholism we may find a threefold cause in hepatic cirrhosis, a hypertrophied and dilated state of the heart, and a diminished activity of inhibitory nervous centres or tracts.

Such are the chief general conditions which may dispose to or produce the disorder; in discussing the local causes it will be convenient to associate these with the three most important epochs in the sexual history of woman, which are (i.) puberty and the early years of menstrual life; (ii.) the period of fertility; and (iii.) the menopause.

(i.) **Menorrhagia during puberty and the early years of menstrual life.**—From what has already been said it may be gathered that in young girls the causes of menorrhagia are for the most part of a general kind. In such cases local examination, except under the most urgent circumstances, is to be avoided; and treatment ought to be directed to the improvement of the general health, and especially to the nervous and hæmopoietic systems. If in such cases local examination is indispensable it should be made by the rectum, unless vaginal examination be absolutely imperative. In either case the patient should be anæsthetised.

On the occurrence of every menstrual period, a condition of *pelvic hyperæmia*, short of actual inflammation, with its various stages of congestion, exudation, and resolution or suppuration, is established. In some cases this hyperæmia is so much exaggerated as to give rise to distressing symptoms resembling those of acute inflammation of the uterine appendages, in addition to menorrhagia. This event is not an uncommon result of the reflex irritation which accompanies the occurrence of the first menstrual period, especially in the case of girls who are brought up in refinement, and who are overtaxed at school. The fact that local irritation may dangerously increase this condition of hyperæmia must not be overlooked.

(ii.) **Menorrhagia during the period of fertility.**—In cases of this class a local cause is more commonly to be found, even if some coexisting general condition accentuate the symptoms. In these subjects local examination must be promptly considered and unhesitatingly urged: hæmorrhage is too dangerous a symptom to admit of delay.

As in the former class of cases, *pelvic hyperæmia* is the immediate cause of hæmorrhage. Local irritation may be found in the first sexual act or in excessive indulgence. Lactation too prolonged acts in the same way, and also by lowering the general tone of the system. In these cases, unless the cause be removed, the line between mere congestion and active inflammatory changes is readily overstepped.

Fibroid tumours, which are a very common cause of excessive flow, probably likewise act by causing an increased vascular supply to the uterus, and also by producing an enlarged and inflamed secreting surface: thus we find excessive bleeding as a result of all enlargements of the uterus from neoplasms and from subinvolution; and of all inflammatory conditions of the peritoneal, muscular, or mucous coats.

Uterine displacements, such as prolapse and flexions, are amongst the commonest causes of menorrhagia. The excessive hæmorrhage in flexions is caused, according to some observers, by a temporary accumulation of blood in the cavity of the uterus, which causes distension and an increase of the secreting surface. As more fluid accumulates during the menstrual period, a gush occurs from time to time, so that the patient suffers from alternate retention and escape of menstrual blood. A continuously excessive flow of blood is rare in such cases; in the great majority menorrhagia occurs in gushes. Other observers, however, believe that the menorrhagia in cases of flexion is simply the result of the endometritis, which they consider to be a constant accompaniment of displacements, an opinion with which I entirely concur. Those who support the "retention" theory apply it also to the causation of the menorrhagia of fibroids.

Extra-uterine inflammations, implicating the ovaries and tubes, all give rise—except in their final sclerotic stage—if not to metrorrhagia, at least to menorrhagia. *Ovarian tumours* may have the same effect, although not nearly so markedly as uterine tumours; in fact the growth of many ovarian tumours does not affect menstruation at all; yet disturbances of the circulation in the ovaries may tend to produce hæmorrhage from the uterus without apparently affecting the healthy state of this organ. *Tumours and cysts in the broad ligaments* find a place in the class of causes of congestive hæmorrhage, because they act by interference with the circulation and with the normal position of the uterus.

Another set of causes are those which directly alter the condition of the surface concerned. Endometritis has already been mentioned among the inflammations; but there is a special form of endometritis, known as *villous or hæmorrhagic endometritis*, which gives rise to profuse hæmorrhage, and often simulates primary cancer of the fundus. *Cancer* both of cervix and fundus, *polypi, or tuberculous and other ulcerations*, produce hæmorrhage in great measure because of the changes they effect in the mucous membrane, such as erosion, and consequent implication of the superficial and sometimes of the deep blood-vessels.

A small class of cases may be mentioned, mainly consisting, so far as my experience is concerned, of fat, flabby, anæmic women, whose menstruation, so far as sanguineous discharge is concerned, is entirely in abeyance, and is replaced by a profuse uterine leucorrhœa. This may be as exhausting as profuse hæmorrhage, and is often accompanied by colicky pains. I have never seen any local treatment to be of any benefit in such cases. Careful dieting, exercise, salines, and a course of Marienbad waters constitute the most satisfactory treatment.

Idiopathic hæmorrhage.—There is one form of hæmorrhage not yet mentioned which may occur during active menstrual life. It is referred to by several authors; but in these days one would almost hesitate to mention it were it not for the occurrence of cases which can be assigned to no other class, but must be collected under some such name as Idiopathic Hæmorrhage. I am strongly of opinion that it must be extremely rare for hæmorrhage to occur with no local or general lesion, and yet the following case, which came under my observation some years ago, is very difficult to interpret otherwise :—

The patient, a married woman with four children, whom I had known throughout my whole professional life, had menstruated regularly, but rather profusely. Six years after the birth of her last child, when thirty-eight years old, she was seized, during the course of a menstrual period, with a uterine hæmorrhage so severe that, in the middle of the night, I was obliged to plug her vagina. On the occasion of her next menstruation the same method had again to be adopted to arrest hæmorrhage; and this had to be carried out time after time for five months, although the usual appropriate intermenstrual treatment by hot douching, ergot, etc., was strenuously persisted in; and on two occasions her uterus was curetted and styptics applied to the bleeding surface. Each successive menstrual period left her more and more exhausted. She was examined frequently, with the utmost care, under chloroform; but no local lesion whatever, nor any general condition, could be found to account for this excessive flow. I am well aware that even the smallest polypi may cause profuse and even fatal hæmorrhage; but in this case, after dilatation of the cavity of the uterus and the most careful examination, I could find no trace of any such thing. During the course of a menstrual period the patient died, apparently of syncope. An autopsy was conducted by Dr. Sims Woodhead. The uterus was examined minutely, yet, except that it was slightly enlarged—the cavity measured 3 inches—and contained a clot, no morbid condition was found at all. There was no neoplasm, nor any abnormality whatever in any of the coats of the uterus. In the left ovary there was a large corpus luteum. The thoracic and abdominal viscera were pronounced to be normal. The symptom in this case might have been attributed to hæmophilia; but, as the woman had presented no other indications of this condition either in her earlier or her later life, and as in her family history there was nothing to suggest such a diathesis, there was no course open but to suppose the case to be one of "Idiopathic Menorrhagia."

(iii.) **Menorrhagia at the time of the menopause.**—The menopause is a period which is characterised by the occurrence of hæmorrhages.

The climacteric may manifest itself in three special ways: (*a*) the menses may cease gradually; (*b*) they may cease only after a long-continued series of hæmorrhages; (*c*) they may cease suddenly.

It is with the second of these varieties that we are more especially concerned at present. Whenever at the menopause hæmorrhages are profuse, very careful local examination should be made, in order to ascertain whether the condition be due to the presence of a neoplasm, to some other local cause, or to general causes. A most important point to notice is that, after the menopause has once become established, post-climacteric hæmorrhages are almost invariably due to a local lesion, such as senile catarrh, cancer, or the presence of mucous or fibrous polypi; though cases are recorded in which this symptom has been due to sexual excitement. But it must always be kept in mind that women of a gouty diathesis not only often menstruate very late in life, but have recurrent post-climacteric discharge due to this dyscrasia.

This is not the place in which to discuss the differential diagnosis of cancer from senile uterine catarrh or fungous granulations on the uterine mucosa; but the importance of establishing a certain diagnosis, and of not postponing a local examination till it is too late, cannot be too strongly urged.

The above discussion of uterine hæmorrhage shows, at least, the importance of regarding it rather as a sign than as a disease. While on the one hand the cause of the bleeding in each case must be carefully sought out, we shall remember on the other hand that in young unmarried women the most common causes of menorrhagia and metrorrhagia are constitutional; in fertile women, subinvolution, fibroids, and displacements of the uterus; in single middle-aged women, fibroids; and in women between forty and fifty, either the usual climacteric hæmorrhages, cancer, or fibroids.

The symptoms of menorrhagia are, of course, the symptoms and signs of loss of blood from any part. It may occur suddenly and compromise the patient's health rapidly; or it may occur gradually in increasing quantity month by month, and thus induce anæmia with its consequent results.

The hæmorrhage of a so-called hæmatocele might, no doubt, be described with some truth as an internal menorrhagia. More commonly, however, there is an external as well as an internal hæmorrhage; and as hæmatocele is now regarded as being, in the great majority of cases, due to an early ruptured extra-uterine gestation, it is not necessary to discuss the subject here.

Treatment.—It will be evident from the great diversity of causes that the treatment of the symptoms under consideration must have a direct reference to the cause, and cannot be indicated on general lines to suit all cases.

As we have to decide in amenorrhœa whether it be advisable or not to bring about the hæmorrhage which is in abeyance, so in menorrhagia it is frequently not without benefit to the patient that she should lose more blood than usual, or even that blood should flow at an abnormal time, so long as the loss of blood does not markedly depress her general health. Where salpingitis or ovaritis or other inflammatory condition exists which produces congestion in the structures about the uterus, the local loss of blood may often relieve the pain and reduce the congestive condition. So, as mentioned above, in cases of high venous pressure producing congestion, bleeding from the uterus may prevent congestion or bleeding at parts where it would be much more dangerous.

The treatment of the *general systemic conditions* which were first discussed obviously consists in measures tending to the improvement of the general health. Rest in bed at the time of the flow is frequently advisable; not only because less blood is likely to be lost by a patient lying on her back with the hips raised than if moving about in the ordinary way, but also that a patient lying still, with the head low, can lose more blood with less bodily harm. It is by such a plan as this that the menorrhagia of young girls must be treated before we resort to such means as the hot douche, or indeed to any local treatment. Mental and bodily rest, with careful feeding, are essential; and so is the administration of salines and tonic medicines. The following prescription is so commonly used in my ward that it goes by the name of "The Ward Mixture"—℞ Magnes. sulph. ʒss.-ʒj., Quininæ sulph. gr. iss., Ferri sulphat. gr. v., Acid sulphuric dil. ♏x., Aq. menth. pip. ad ℥j.

But it must be further remembered that very often in cases where the condition may seem to be due to general causes, there exists also a local lesion in the mucosa, which may be the subject of fungoid granulations. In such cases curetting is often of great avail.

Curetting will be found of great service in most cases of menorrhagia and metrorrhagia. Some authors, indeed, recommend its employment even in cases where in the actual state of the mucosa it does not appear to be required; in cases, for instance, where the hæmorrhage is apparently due to nothing more than an inflamed condition of the ovaries.

With regard to general means of checking hæmorrhage it has been found that not much is to be gained by the internal administration of drugs. Out of a very large number of drugs which have a reputation as hæmostatics but very few can be relied upon: of these the foremost is undoubtedly *ergot.* It acts by causing contraction of non-striped muscle, and thus diminishes the calibre of blood-vessels: in the uterus, moreover, it causes contraction of the network of muscular fibres which form the middle coat, and constricts the vessels which pass through that network; but, so far as my experience goes, ergot acts very inefficiently on the uterus except when the muscular tissue is hypertrophied, as after labour or abortion, or in cases of fibroids. Ergotine, especially in conjunction with strychnine or nux vomica, is perhaps the most efficient preparation. Hydrastis alone or with ergot is often of service. Apart from its use in abortion or parturition, the administration of the drug must be long continued in order to be of any benefit. Sulphuric acid and cannabis indica are undoubtedly useful also in certain cases.

The investigations of Dr. Wright of St. Mary's Hospital gave us a remedy applicable in certain cases of menorrhagia and metrorrhagia, namely, calcium chloride. The chloride is a convenient salt of calcium, because it is readily soluble in water; and calcium acts by increasing the coagulability of the blood. In cases, therefore, where the coagulability of the blood is less than normal (and Dr. Wright describes a clinical method of estimating this), the internal administration of the chloride of calcium in doses of gr. xv. would act beneficially by bringing the coagulability up to the normal point. It has been tried in cases of uterine hæmorrhage, and certainly has produced good results in some of them, both as a draught and as a local application.

Of *local applications* none can bear comparison with the use of hot water applied in the form of vaginal douches at a temperature of 120° F. Indeed, there is no better method of checking a long-continued menstruation than to douche the patient regularly with hot water. Many women object to the practice; but it is, nevertheless, a perfectly safe and satisfactory way of stopping a long-continued menstrual discharge. Experiments on the uterus in some of the lower animals have proved that hot water as a muscular stimulant is much more beneficial than cold. The contraction produced by hot water is more rapid, and, what is more important, it is continued for a longer time than that produced by cold. Moreover, it must be obvious that the effect of a hot application on the system must be much better than that of one which removes a considerable amount of heat from a body already reduced by loss of blood.

The local application of styptics, especially by means of Playfair's probe covered with cotton wool and dipped in some astringent solution, is often of the utmost value, even without any previous curettage. Adrenalin applied locally sometimes has excellent effects.

Plugging of the vagina with damp antiseptic wool is often most serviceable; in exceptional cases the uterus may be packed with antiseptic gauze. It has been said that this packing may result in a dangerous regurgitation of fluid through the Fallopian tubes; but this event, so far as I know, is extremely rare, and, if it does occur, is not associated with any serious symptoms. Plugging is a good temporary method of checking hæmorrhage, and gives time for the application of measures to restore the patient's strength, and for the adoption of more permanent remedial means.

Electricity.—The constant current in the treatment of menorrhagia seems to me to have a specially beneficial effect in those hæmorrhages which occur at or near the menopause, when the uterus is undergoing atrophic changes. It is also useful in the subinvolutions of actively fertile women—although I am obliged to add that in two cases thus treated subinvolution led up to superinvolution, with subsequent permanent sterility. In these cases, therefore, this method of treatment must be carried out with special precautions.

Removal of the ovaries.—As regards the treatment of menorrhagia, apart from any uterine neoplasm or general condition, by removal of the ovaries, I will give here the reports of two cases :—

1. A girl, twenty years of age, unmarried, suffered for three years from hæmorrhage to such an extent as to render her a complete invalid. When she came under my observation her menstrual flow lasted for fourteen days. At the end of her period she was bloodless, and subject to frequent faints. The uterus was curetted, and she was put under long courses of styptics and douching, with little if any benefit. As a last resource removal of the ovaries was considered and ultimately carried out. She has never menstruated since, and is now a staff nurse in a hospital in the enjoyment of perfect health.

In this case the ovaries, although somewhat enlarged and heavy, were not the subjects of any cystic or other degeneration, and the cause of her uterine hæmorrhage was not otherwise apparent.

2. Another case occurred of a somewhat similar character. A young lady of twenty-five had been married for four years and was sterile. She bled so profusely at her periods, and occasionally intermenstrually, that she was practically bedridden. The uterus was apparently normal. She had no general disorder, and after the usual treatment for a long time by curetting, styptics, and hot douching, no improvement resulted. After careful consultation, and with the concurrence, of course, of herself and her friends, the ovaries were removed. Since that time, ten years ago, menstruation has not returned, and she has been in the enjoyment of excellent health. The ovaries, as in the former case, were simply enlarged and heavy.

In neither of these cases was there any reason to suppose that any sexual irritation existed. Now, although I am very far from recommending such a course for frequent adoption, I mention these cases as extreme ones, needing extreme measures. No operation in gynæcology requires to be more safeguarded than that for removal of the ovaries; it is, unfortunately, an easy operation, and one far too frequently performed. I mention the above cases as exceptional ones.

The treatment of uterine displacements, cancer, fibroids, and all other local conditions which give rise to hæmorrhage, must be sought for in other parts of the *System*.

DYSMENORRHŒA.—All women, even while enjoying good health, feel "unwell," as they themselves call it, at the menstrual period. They experience some pelvic discomfort or inconvenience associated with a general malaise, some indefinite pains in the back and loins, and a certain irritability of temper; that a woman should not be thus affected would be almost abnormal. However, I do not for a moment deny that some women menstruate with no trace of suffering whatever, the presence of the discharge being only an inconvenience. It is easy to understand the "normal" discomfort if the nature of the function of menstruation is considered. It is impossible to suppose that the various changes, especially congestion, which occur during the different stages of the process of normal menstruation should take place without giving rise to a certain amount of pelvic and general discomfort. But the difficulty lies in fairly estimating the suffering of the individual, and in determining when the disorder has ceased to be physiological and has become pathological. The sensitiveness of the nervous system in women varies so much that what is described by some as an "inconvenience" by others is called "discomfort"; what is to some "discomfort" to others is "pain"; and yet others, again, who call their suffering "a little pain" endure as much as many who describe their sufferings as "agonising" or "excruciating." One must, therefore, draw a line of demarcation between the mere discomfort of menstruation—no matter how it is described by the sufferer—and genuine dysmenorrhœa, which is graver pain occurring at or about the menstrual epoch; pain so severe as to interfere with health, with work, or with pleasure. It is not easy to lay down a hard and fast rule in the estimation of pain, which, after all, is a symptom which does not directly appeal to any of the senses of the physician. With limitations, however, it may be concluded, in the case of a poor woman who has to work for her daily bread, that if her dysmenorrhœa is not sufficient to lay her up and so to withdraw her from her duties, then her suffering requires no special local treatment; in the well-to-do, if the pain does not deprive the sufferer of her social enjoyments and amusements, it likewise calls for no special local treatment. In these cases even a vaginal examination, at any rate in the unmarried, should not be undertaken, or at all events not without a prolonged trial of general remedies and management. But there is no doubt a very large number of women who constantly demand and deserve our attention on account of menstrual suffering. Their pain is not the mere discomfort of all women, nor the temporary severe pain of many, but a prolonged agony; in some cases so extreme as for years to render life a burden. No sooner has the pain of one epoch passed than they begin to dread with horror the next; and so life is rendered miserable. The disease, or rather the symptom, seldom leads directly to death; but it does interfere to a very large extent with fertility, health, and happiness, and in some cases it gives rise to habits, such as the taking of drugs and alcohol, which may become incurable. With such a state of things one has frequently to deal in practice, perhaps more frequently than with any other disorder of menstruation; and, further, the reflex and sympathetic disorders associated with dysmenorrhœa, *e.g.* the mental and nervous derangements, are many. These neuroses, due mainly to changes in the ovaries, are well recognised, and must be carefully considered in dealing with dysmenorrhœa.

There is no very definite relation between the amount of flow and the degree of dysmenorrhœa: although in many of the spasmodic and membranous forms, as we shall see further on, the discharge is often scanty; yet it is often profuse in the ovarian and tubal forms, in both of which the pain is equally well marked. Perhaps, on the whole, uterine dysmenorrhœa is more marked when the menstruation is scanty than when it is profuse.

In some women the dysmenorrhœa begins with puberty, and, unless active treatment is adopted or pregnancy occurs, it continues all through adult life; in others it arises only after some distinct exciting cause, such as a chill, or under conditions which give rise to inflammatory or other changes in the uterus or its appendages. No doubt dysmenorrhœa is commoner among unmarried women, but sometimes it sets in only after marriage. When met with in married women it is frequently associated with sterility; and it is certainly less frequent among parous women than in the nulliparous.

Dysmenorrhœa and Sterility.—Some relation between dysmenorrhœa and sterility has been observed frequently enough. In many cases the association is accidental. So far, indeed, as I am able to judge, the association of dysmenorrhœa with sterility is not so close as is generally supposed.

Kehrer, who has gone into this matter at some length, has shown that a history of painful menstruation before marriage is only slightly more common in sterile than in fertile women. Kammerer gives a table of 408 cases of sterility, in 67 of which dysmenorrhœa was a prominent symptom; Jackson gives a table of 72 cases of sterility, in 16 of which dysmenorrhœa was a prominent symptom. Certainly, on reflecting upon my own experience, I should not be inclined to give dysmenorrhœa a prominent place in relation to sterility. Obstructive dysmenorrhœa, putting the term conversely, and regarding various conditions of the uterus as obstacles to conception, scarcely appears to me to have any foundation; in fact, as Jackson says, "The obstacles which are overcome by spermatozoa in their progress towards the uterine cavity are, to say the least, remarkable."

The view which commends itself to me is that, in cases of dysmenorrhœa associated with sterility, the explanation of both conditions is to be sought for rather in general congestion of the pelvic organs, more especially of the endometrium, than in any mechanical cause. The dysmenorrhœa is accounted for by hyperæmia; and the sterility, not by any mechanical interference with conception, but rather by some condition of the endometrium which interferes with the continuance of gestation. In other words, the dysmenorrhœa is due to congestion of the uterus associated at times with spasm of the os uteri internum; and the sterility to a hyperæmic and hyperæsthetic state of the endometrium.

Such a view as this explains how it is that, after treating various conditions of apparent mechanical obstruction — such as anteflexion, stenosis, and so on—the sterility continues. A very large number of the processes concerned in generation are, no doubt, wholly mechanical; and it is not surprising, therefore, that in cases of sterility which present some apparent obstacle of a mechanical character, this obstacle should be promptly accepted as the efficient cause, and mechanical means adopted for its relief. It is certain that the cure of an anteflexion or a retroflexion, or in other words the removal of causes apparently mechanical, has resulted in the cure of dysmenorrhœa; and we have learned clinically that it has sometimes been followed by a pregnancy. Far oftener, however, these mechanical means, while relieving the dysmenorrhœa, have failed entirely to remove the sterility,—failed, no doubt, because they did not remove some condition other than the mere narrowing of the cervical canal; such a condition seems to me to be a morbidly hyperæmic state of the endometrium, which renders the grafting of the ovum an impossibility.

The Varieties of Dysmenorrhœa.—The classifications given by different authors are endless, but many of them have been framed upon erroneous notions of the nature, firstly, of menstruation, and, secondly, of dysmenorrhœa. For example, many arrangements have been suggested on a purely mechanical or obstructive view of the causation—as if due to displacements, stenosis of the cervix, and so on; and while these are, no doubt, elements in the causation, yet some deeper cause underlying it all, underlying all the varieties and forms, must be looked for. The initial difficulty in discussing dysmenorrhœa lies in our ignorance of the ordinary physiology of menstruation. I cannot here discuss the various theories of menstruation, they must be sought elsewhere; but I may say briefly that in all varieties, no matter where the exact origin of the pain may be, the essence of dysmenorrhœa is *congestion.*

It is easy to make a primary classification of the varieties of dysmenorrhœa which probably no one will dispute—namely, to divide the various forms, clinically, into (I.) Uterine, (II.) Extra-uterine. This classification is based upon a clinical consideration of the nature of the pain, and of the organs primarily affected.

Others have classified the varieties as *primary* and *acquired*; and this arrangement no doubt is occasionally useful. Primary dysmenorrhœa is that form which sets in at early puberty and continues into adult life. It is found associated with defective development, and leads subsequently to the spasmodic form of dysmenorrhœa. Acquired dysmenorrhœa is found in young women after attacks of the exanthemata, or after chills; in parous women it follows sepsis after an abortion or a full-term labour, and so on.

It is not now matter for dispute that a uterine and an extra-uterine form of dysmenorrhœa exist; but difficulties arise as we recognise that the varieties are very often mixed; and still greater difficulties are met with when we attempt to arrange the different causes, especially of uterine dysmenorrhœa. The difficulty, however, does not lie in the clinical distinction of the forms, but rather in the proper naming of each kind. Different minds are apt to associate different meanings with the same word, and hence confusion arises.

Four factors, roughly speaking, are concerned in the production of dysmenorrhœa. *First*, some morbid condition in the shedding off of the mucous membrane in whole or in part, seen in its most pronounced form in membranous dysmenorrhœa. In a state of health the process of disintegration, I apprehend, takes place with little trouble; but if, on the other hand, from some such cause as the changes produced in the mucous membrane by long-standing inflammation, the process be retarded, centres may be furnished for the formation of clots; and these, increasing in size and becoming foreign bodies, lead to violent intermittent contractions. *Secondly*, the consequent difficulty and pain of the uterine contraction; which are still more marked if the uterine muscle be the seat of any inflammatory change. *Thirdly*, some obstruction to the overflow of the uterine discharge, leading subsequently to retention and congestion. *Fourthly*, and lastly, these local conditions, themselves a source of local pain and discomfort, may be aggravated in each individual case according to the nervous constitution of the sufferer. In other words, the whole condition is one of hyperæmia and hyperæsthesia.

I. **Uterine dysmenorrhœa.**—A. *From defective development and obstruction.*—The first class of cases of uterine dysmenorrhœa to which I would refer is that associated with defective development. In such cases the uterus continues after puberty in a more or less infantile condition: such a uterus is frequently found in young chlorotic girls, and it is associated with a marked form of dysmenorrhœa. An undeveloped organ performs its function badly, and the uterus is no exception to the rule. Ill development has been specially studied by Sir John Williams, and the connection between this condition and dysmenorrhœa has been particularly emphasised. It has further been pointed out that the younger the sufferer from painful menstruation, the more defective the development of the pelvic organs.

Into this class of cases we may fairly admit the dysmenorrhœa of young women who suffer from a displacement, especially from anteflexion of the uterus. The position is, however, nothing more than the persistence of the normal condition in the child; in short, it is a defect of development. This unripeness of the uterus may show itself in other ways than in a flexion of the body on the cervix. Frequently stenosis of the os is an indication of ill development; and when either a flexion or a stenosis, or both exist, dysmenorrhœa, frequently called obstructive or mechanical, is the most prominent symptom of the existing condition. But while not denying the possibility of a purely obstructive dysmenorrhœa from narrowing either of the os or of the whole cervical canal, I venture to say that uncomplicated cases are very rare. Mechanical obstruction causing pain is possible at the beginning of menstrual life; but ere long a secondary congestion, and even actual inflammatory changes from retention of menstrual flow, are the inevitable result.

There are many objections to the "mechanical theory" of dysmenorrhœa. It has been urged that if blood can flow through a capillary tube, the os or cervical canal, however narrowly contracted, cannot offer a positive obstruction; and it is further pointed out that many women with most marked flexion and a pinhole os menstruate with no abnormal discomfort. These and other objections are no doubt potent in many cases, and I believe that in a case of any standing, an inflammatory condition must be superadded to the obstruction; so that most of these cases would be grouped in the second class of uterine dysmenorrhœa to be mentioned later. I do not wish it to be supposed that cases are frequent in which the only morbid conditions to account for the symptom of dysmenorrhœa are a flexion or a stenosis without any indication of excessive congestion or inflammation. The chief symptom of congenital anteflexion is undoubtedly dysmenorrhœa characterised by violent pains in the loins, where the blood distends the body of the uterus—the part, that is, above the point of flexion; suddenly the obstacle is overcome and the collected menses, partly fluid and partly in clots, are expelled. The purely mechanical theory of dysmenorrhœa, since it was made known by Simpson and Sims, has been accepted by most authors. It is rejected, however, by Champneys and by Fritsch; the latter explains the pain as due to irritation from congestion; the abnormal vascular tension resulting from the interference with the circulation in the vessels at the point of flexion, irritates the nerves of the uterus and so causes the pain. However, the paroxysmal and alternating character, both of the pains and of the discharge, almost compel one to consider the obstruction to an easy flow as of vital importance.

It has even been suggested that, as the result of anteflexion and consequent obstruction, a few drops of blood are every month forced along the Fallopian tubes into the peritoneal cavity, giving rise to a periodic and miniature hæmatocele. These small internal hæmorrhages are considered by some observers to be the cause of the posterior perimetritis which sometimes accompanies anteflexions; this inflammatory condition if present would account for the acute febrile phenomena with which the dysmenorrhœa of anteflexion is sometimes associated.

B. *Spasmodic and Inflammatory.*—Cases in the previous group, as age advances, frequently merge into a second class of uterine dysmenorrhœa, namely, the spasmodic and inflammatory.

The continuance of the mechanical form leads, sooner or later, to hyperæmia and then to subacute inflammation; thus the so-called "spasmodic dysmenorrhœa" is established. This very well recognised form of dysmenorrhœa is the result of spasm, not only of the uterus, but of the os internum, occurring in an organ subacutely inflamed. Whether the subacute inflammation be due to the retention of clots in a displaced uterus, which act as foreign bodies and cause congestion and spasm, or to an alteration in the circulation of the uterus caused by the flexion, is a matter which scarcely admits of definite settlement. Though this form may sometimes be primary, from any cause which may lead to accidental congestion or inflammation of the uterus, it is, as we have seen, usually secondary to dysmenorrhœa, arising from defective development or simple obstruction.

The dysmenorrhœa associated with fibroid tumours of the uterus may also be included in this class. No doubt many of these cases may be attributed to the obstruction which the tumour offers to the easy escape of blood; but in most of them the inflamed condition of the uterine mucosa which invariably accompanies the neoplasm is the cause of the suffering.

Many describe as "constitutional" a gouty, a rheumatic, and a neuralgic form of menstrual pain. But all these, I believe, are associated at least with congestion of the uterus, and many with a marked subacute form of inflammation; they are therefore rightly included in this class. The dysmenorrhœa in such cases is simply the evidence of an inflammation similar to that which occurs in other organs in those who are the subjects of such diatheses. That this kind of dysmenorrhœa is common there can be no reasonable doubt. How else are we to account for the persistence of dysmenorrhœa in members of the same family? How else are we to account for the persistence of sterility associated with dysmenorrhœa in members of the same family? I have frequently seen families in which the daughters were all dysmenorrhœic and all sterile. Now in such families I believe that the dysmenorrhœa is due to gouty or rheumatic inflammation of the endometrium, with a resulting spasm of the os uteri internum; and that the sterility is due, not to interference with conception, but rather to the congestion of the mucous membrane, which thus forms a bad nidus for gestation.

Symptoms.—The situation of the pain is usually in the neighbourhood of the pubes. The pain is described by the sufferer as "bearing down," and comes on in spasms, intermittently. It resembles colic of a severe type. The pain lasts for the first day, and, indeed, until the discharge is distinctly established, when relief is obtained. The actual flow may be scanty, but it is generally accompanied by clots. The severity of the pain varies; it is sometimes so severe as to be associated with nausea, vomiting, and utter prostration. Occasionally the suffering recurs on the second or third day, owing no doubt to the attempts of the uterus to expel accumulated clots.

Spasmodic dysmenorrhœa has no tendency to spontaneous cure, but, unless the patient be subjected to appropriate treatment or become pregnant, it becomes more and more aggravated as time goes on. When pregnancy does occur, and goes on to full term, the patient is usually cured.

The *diagnosis* of these cases must be accurately made, because upon accurate diagnosis depends efficient treatment.

Of course it occasionally happens that a spasmodic dysmenorrhœa is associated with other kinds; but when the condition is simple it is to be recognised: 1st, by the fact that the pain occurs in the first twenty-four or forty-eight hours of the menstrual period; 2nd, that there is no appreciable change in the uterine appendages; and, 3rd, that the uterus is freely movable, and usually flexed either anteriorly or posteriorly. When such a state of things is ascertained, treatment is satisfactory.

Treatment.—This resolves itself into—(1) Palliative, which applies to all forms of dysmenorrhœa; (2) Radical.

1. *Palliative treatment.*—This consists, first of all, in dealing with any general condition, such as anæmia, gout, or rheumatism,—maladies

to be treated by iron and arsenic, colchicum, and the salicylates respectively. In the second place, the treatment of the actual pain is to be conducted first of all, and mainly, by pelvic depletion. Anything that depletes the pelvis proportionately diminishes the hyperæmia upon which the pain depends; and, therefore, the free use of salines before the periods is of the utmost value. Patients must be taught that it is not only safe but very advisable that laxative medicine should be taken during the period if there be constipation. They often expressly avoid such drugs at these times. Very often, in anæmic women, a continued use of chlorate of potash, iron, and actæa racemosa, used in combination for a week before and during the period, will give much relief.

For the actual suffering, antipyrin, phenacetin, and the other coal-tar derivatives of this group will be of service; pulsatilla, also, either as the tincture in five-minim doses every hour, or combined with caulophyllin, is most useful; in my experience it has been eminently satisfactory. When the pain is excessive, nitrite of amyl or nitro-glycerine may be administered with advantage.

Such peripheral sedatives as cicuta verrosa and castor are useful. Undoubtedly opium and alcohol give the most prompt and efficient relief; but their temporary employment may induce a permanent habit, and therefore they are to be employed with the utmost caution. Diaphoretics, warm hip baths, sinapisms, and hot drinks will all relieve the distress to a certain extent.

2. *Radical treatment.*—In cases of defective development in young girls nothing beyond palliative treatment is to be attempted. But when the case is obstructive, or primarily or secondarily spasmodic, then the local treatment is clear and definite; and, as a rule, if undertaken carefully, is entirely satisfactory. If the manipulations to be described are carried out with careful antiseptic precautions, and there be no peri-uterine disturbance, an absolute cure can in most cases be anticipated.

In dealing with a case of spasmodic dysmenorrhœa which resists the ordinary palliative treatment, and where the symptoms are sufficiently severe, a vaginal examination ought to be made under an anæsthetic. If the uterus be found freely movable—anteflexed or retroflexed as the case may be—and the uterine appendages healthy, the indications for treatment are obvious. There are several alternative means: the first and best is as follows. Under anæsthesia, the cervix, fixed by a volsella, should be gradually dilated by a series of bougies, either metallic or those of Hegar; in a few cases the mere passage of the uterine sound immediately before a period is sufficient to relieve the pain. Secondly, as an alternative, the cervix may be rapidly dilated by Sims' or Ellinger's dilators. Either of these methods will in most cases be found satisfactory. The operation, however, has occasionally to be repeated. Thirdly, if the flexion backwards or forwards be very acute, a stem pessary may be found useful. I am well aware of the risk of using these instruments, but, with due care and precaution, excellent results may be obtained, even in some persistent cases.

It is essential that immediately after the introduction of the intra-uterine pessary the patient should be kept in bed and carefully observed for some days. As a rule the introduction is speedily followed by spasmodic pains in the uterus, but these soon subside. Occasionally, however, a more serious pain results, that of pelvic peritonitis; and should there be the slightest indication of this, the stem should be removed instantly. It is almost impossible to determine beforehand whether a uterus will tolerate the introduction of a foreign body. Some uteri are extremely tolerant, others will not endure the slightest mechanical interference without inflammatory reaction. Before one ventures to use a stem pessary, it should be determined that the uterine appendages are perfectly healthy; the personal equation of the uterus also should be estimated, so far as possible, by the frequent passage of the sound. If the stem pessary can be worn without discomfort, the patient may get up after a few days, and after a week or two a larger stem may be substituted. The cases which, as a rule, are most satisfactorily treated by this method are those of aggravated congenital flexion. The patient should not be subjected to the risk of a stem pessary until all other means have failed, and then only with the utmost caution.

One other method of treatment of this form of dysmenorrhœa remains; but it may be dealt with shortly, as within recent years it has fallen into desuetude, at any rate in this country.

Sir James Simpson was the first to advocate *division of the cervix*; and he was led to adopt this method by the common observation that dysmenorrhœa is much less frequent in parous women than in the nulliparous. Acting on the supposition that the shape of the cervical canal is important in the causation of the menstrual pain, he so divided the lips of the cervix that its condition in a non-parous woman approximated to that of one who had borne children. The operation is performed with the metrotome or with Küchenmeister's scissors.

Sometimes the operation, instead of being a bilateral one as advocated by Simpson, is single; and either posterior or anterior, according to the flexion: the object in view being to straighten the canal distorted by the displacement. But the operation of division of the cervix is by no means a safe one. Putting aside the risk of sepsis, the hæmorrhage is frequently most alarming, so much so that if it is to be performed, previous ligation of uterine arteries, or at least of the lower branches, is now considered necessary. Very few operators, however, now employ the method.

C. *Membranous dysmenorrhœa.*—Morgagni (23) first noticed a variety of dysmenorrhœa in which at each menstrual period, or at every second, third, or fourth period, a distinct membrane is shed from the uterus during the flow which is accompanied by severe pain. If one accepts the desquamation hypothesis of Sir John Williams, membranous dysmenorrhœa is easily explained; and, similarly, if the hypothesis of Engelmann be correct—that during menstruation a proliferated mucous membrane is shed—then we can say that membranous dysmenorrhœa is merely an exaggeration of a normal process, and that the membrane is discharged in mass instead of in minute particles.

This curious affection was formerly supposed to be inflammatory; and the shed membrane was compared to the inflammatory exudation cast off from the respiratory passages during an attack of croup. But for many years it has been known that we have to deal, not with an inflammatory exudation, but with an exfoliation of the mucous membrane of the uterus. This resembles the early decidua in some respects, and may form a triangular-shaped sac with three openings, rough and irregular on the outer surface, smooth on the interior. Examined microscopically, the membrane does not possess the complex structure of a decidua, and the characteristic decidual cells are absent. Sometimes the membranous sac is cast off entire, but more commonly it is shed in pieces. Occasionally only the superficial layers of the mucous membrane are cast off; much more commonly the membrane is thick, and represents the whole thickness of the hypertrophied and swollen endometrium.

Virchow says that, on examining the uterus after death in women who have died while suffering from dysmenorrhœa, he has found the mucous membrane in process of separation. Wylie says that if it be accepted that a cellular disintegration takes place during normal menstruation, it is possible to imagine that if this degeneration take place in the deeper layers of the mucous membrane, before the breaking down of the more superficial layers, the latter might be thrown off as a membrane.

It has been suggested that the membrane expelled belongs to, or is the product of, the former menstrual period. If normally the mucous membrane is thrown off during the latter days of the flow, it would seem that in these cases of membranous dysmenorrhœa the exfoliation is postponed; and the membrane continues to grow during the intermenstrual period.

Hausmann adopted the view that these membranes are early abortions; but, although the membrane is not distinguishable from decidua, the repeated occurrence and the absence of the villi of the chorion make a distinction between them, as a rule, comparatively sure.

Symptoms.—The condition is peculiar to married women, although minute shreds may be observed in single women. The membrane is cast off as a whole, or at any rate in tangible pieces, on the second or third day of the flow, every month, or every second, third, or fourth month. The discharge is accompanied by severe colicky pains which are sometimes of a most violent nature. The flow may be excessive or normal in quantity; but it frequently presents an intermittence, due probably to the plugging of the os internum by the membrane. The patients are sterile, and this state is due to the mucous membrane being so altered structurally that it does not form a suitable nidus for the ovum. Membranous dysmenorrhœa is frequently associated with other uterine disease, such as uterine catarrh or displacements; but these alone do not account for its existence.

The prognosis is uniformly unfavourable, as in most well-marked cases it continues during the menstrual life of the patient.

Treatment.—Any existing complication should, of course, be removed; and thereafter the dysmenorrhœa is best treated by free dilatation of the cervical canal, curettage of the uterus, and the application of strong escharotics to its interior. Intra-uterine drainage, too, has sometimes been followed by fairly satisfactory results. If these means fail, and the patient's suffering continue, the alternative of removal of the appendages, so as to induce premature menopause, would have to be considered, or possibly a vaginal hysterectomy and conservation of the ovaries.

Internally no medicines have a better effect than the continued use of arsenic, iodide of potassium, and mercury.

II. **Extra-uterine dysmenorrhœa.**—The extra-uterine variety of dysmenorrhœa is that which has its origin in some abnormal condition of the uterine appendages. It is commonly called "ovarian," but in many cases the cause of the pain lies in the Fallopian tubes, or in the pelvic peritoneum in the neighbourhood of the ovary.

This form of dysmenorrhœa is associated with a very definite set of symptoms, and may occur in either the single or married woman: it is found, however, more frequently in married or parous women than in the single, for the reasons we shall presently see. The ovaries and tubes in young women may become the seat of inflammatory changes, as the sequel of any of the exanthemata, or as an after-result of influenza, or, at times, as the consequence of a direct chill. At other times, again, they may become thus affected in young women by an inflammatory process spreading from neighbouring organs. In married or parous women, while these influences may be at work in producing a salpingitis or ovaritis, or a combined salpingo-ovaritis, yet in these there are other factors more prominently at work; the first of them is the spreading of sepsis into the uterine appendages as the result of abortion or parturition.

In these cases, if the inflammatory process be at all well marked, and more especially if, as is generally the case, it affects both sides, the usual results are acquired dysmenorrhœa and sterility. Now such a condition can be quite well recognised clinically, though it may present different features in various cases. For example, one or other ovary may be simply enlarged, tender, and prolapsed low down into the pouch of Douglas; of the two ovaries the left suffers most. Again, the tube may be enlarged and thickened, or may be the seat of one of the grosser lesions, such as hydro-, pyo-, or hæmatosalpinx; or the appendages on one or both sides may be matted together by perimetritic effusion and deposit. Further, there is a cause, but too frequent, in both single and married women, of inflammatory disease of the uterine appendages: namely, the infection from gonorrhœa. Yet another source of infection is, unfortunately, well enough known; a salpingo-ovaritis may very easily be set up as a result of ill-managed operative interference on the uterus itself, by the improper or injudicious use of instruments, and by the disregard of antiseptic precautions.

It must be obvious that no such condition of salpingo-ovaritis can be present to any extent without implication of the uterus in the inflammatory change; hence it comes that under these conditions a mixed form of dysmenorrhœa is met with: the symptoms are sufficiently definite, however, to indicate the tubal and ovarian origin of the pain. It is no part of my present duty to describe the symptoms in general to which tubo-ovarian inflammation gives rise, among which are constant pelvic pain, menorrhagia, pain during defæcation, dyspareunia, and especially dysmenorrhœa. Now this dysmenorrhœa manifests itself in a characteristic way. It is essentially premenstrual, that is to say, the constant pelvic uneasiness of which the patient complains passes into definite suffering and pain from three to six days before the external manifestation of menstruation. If the uterus be but slightly implicated the patient sometimes gets relief on the onset of the hæmorrhage; but, on the other hand, if the endometritis be marked, or the salpingo-ovaritis of a high degree, the pain will probably continue all through the period. This pain is mainly confined to the region of one or other ovary, and is often so severe as to keep the patient in a state of unrest for days before menstruation sets in. The reason of this premenstrual pain is that the tubes and ovaries, already in a chronically inflamed state, become gradually more and more congested as the day of menstruation approaches; thus when the flow is established, and the congestion reduced, a corresponding relief is obtained in many cases; and the patient, although never absolutely free from pain, remains comparatively well for ten days or a fortnight after her period.

The *prognosis* is essentially bad. Perhaps, next to membranous dysmenorrhœa, this variety is the most difficult to cure. In the form affecting young girls the results are decidedly more satisfactory than in those women in whom the disease is directly the result of abortion, parturition, or gonorrhœa. Further, one main element in the prognosis is the ability of the patient to obtain the advantages of long rest and prolonged treatment. Yet in any case, so far as the cure of the dysmenorrhœa is concerned, the prognosis must always be very guarded.

In this, as in all other varieties of dysmenorrhœa, there are *two methods of treatment—the medical and the surgical.* With regard to the medical treatment; as the constant cycle of changes through which the uterus and its appendages are month by month passing is one of the most important factors in the delay of cure, it is clear that the patient must be withdrawn from any conditions which might accentuate these changes. Hence the first provision is complete rest—mental, physical, and sexual. This must be associated with those remedies which reduce hyperæmia and disperse deposits. First and foremost comes systematic hot douching, accompanied by the introduction of ichthyol, either as a pessary or as a dressing, into the vagina. I know of no drug which has a more powerful local effect, and I am confident that its persistent use has saved many an ovary from the surgeon's knife; but its use must be persistent. To paint the roof of the vagina with iodine (half-and-half tincture and liniment) twice a week, and to place an occasional blister over the brim of the pelvis, will facilitate the cure. Internally, liquor hydrargyri perchloridi, with iodide of potassium and saline purgatives, will be found beneficial.

It is obvious that such treatment will in any case be tedious, and more or less so according to the severity of the inflammation; thus it must be evident that such treatment is obtainable only by the comparatively well-to-do; and even in them, when the condition has become chronic, a complete cure is by no means frequently met with. In these patients, after the treatment has been carried out at home for some months, a course of baths at Woodhall Spa or Ems will be of much value. For the palliative treatment of the dysmenorrhœa proper, most of the drugs to which I have already referred will give temporary relief. Yet it comes about that under three possible circumstances surgical treatment has in many cases to be taken into consideration: these circumstances are—(*a*) long-standing and intractable dysmenorrhœa; (*b*) various mental and nervous phenomena, said to be associated with dysmenorrhœa; and (*c*) inflammatory or grosser lesions in the uterine appendages associated with dysmenorrhœa and other symptoms.

I think there are few cases, if any, in the first set in which the procedure can be recommended, as most kinds of uterine and extra-uterine dysmenorrhœa can be palliated without recourse to oophorectomy. It is only justifiable when the dysmenorrhœa is associated with the other well-marked symptoms to which tubal and ovarian disease gives rise. The operation, as a rule, is an easy one, and is undertaken too often on insufficient grounds. Further, even after oophorectomy a cure is by no means uniformly obtained, because, as I have already said, the menopause is not invariably induced; the patient often menstruates regularly, and sometimes even with pain; moreover, though menstruation may cease, periodic monthly pain may recur for a year or two at least. In all cases, removal of the ovaries should not be adopted until all other means of treatment have failed; and then only as a last resource.

INTERMENSTRUAL PAIN.—There is a form of dysmenorrhœa, if so it may be called, which occurs, not at the time of the external manifestation of menstruation, but at mid-term; to this condition the Germans have given the more appropriate name of "Mittelschmerz"; the French, less felicitously, the name of "Dysmenorrhée intermenstruelle." Whatever name may be applied to it—and certainly intermenstrual dysmenorrhœa is not a suitable one—the condition in which an attack of dysmenorrhœa proper is simulated, without, necessarily, any external hæmorrhage, is well ascertained. It does not at all resemble the pre-menstrual pain, or the continued pain associated with inflamed or diseased ovaries; but it is a condition which occurs definitely each month, at a definite period.

So far as I am aware, the condition was first of all described, many years ago, by Sir William Priestley; it has been also discussed by Fasbender and Sorel.

The four cases recorded by Priestley had the following as their prominent features: paroxysmal pain, in the region of the ovary, occurring during the intermenstrual period; in some cases continuing up to the commencement of the flow, in others stopping before it; the ordinary flow is usually scanty, but regular, and with no pain. In two cases, on bimanual examination, a tumour was felt in the region of the broad ligament, adherent to the uterus, elastic to touch. In the other two cases only thickening in the region of the broad ligament was found.

Sorel records a case presenting symptoms similar to those mentioned above, in which the condition had existed for a great number of years; indeed, it had been observed during a period in which 147 menstrual epochs had occurred. The chief conclusion arrived at by this author was that the occurrence of the intermenstrual pain bore a more definite relation to the commencement of the period which followed it than to the period which went before, as fourteen days always elapsed between the occurrence of the pain and the commencement of the next menstrual period.

One of the most important contributions to the very scanty literature of this subject is an article by Heinrich Fasbender, in which he expresses his view of the etiology of "Mittelschmerz" as follows :—"Accepting Pflüger's theory of menstruation, we have in some cases a premature summation of nervous stimuli in the ovary, with the occurrence of ovulation, caused by a delicately organised and excitable state either of the whole nervous system, or of the nerves of the ovary; the latter state produced by a pathological condition of the ovary. This abnormal irritability, leading to dehiscence of a follicle some fourteen days before the proper menstrual period, produces the congestive condition of the pelvic organs found in cases examined at such a time."

"Mittelschmerz," with a slight flow of blood, is also described by Benicke as occurring in a case where there existed a conical cervix with pinhole os, anteflexion of the uterus, and retraction of the utero-sacral ligaments.

From the above notes, along with my own recorded cases (8), the condition, it seems to me, can be well considered under three different manifestations: (*a*) a group of cases in which there is no external discharge at all; (*b*) those cases where the pain is associated with an escape of blood; (*c*) those in which, as in two of my cases and some of the others, the intermenstrual pain is associated with a clear discharge.

It would be absurd to dogmatise upon the causes of this condition; or to lay down any hard and fast rules as to the pathological conditions necessary to its production; but it seems to me that the above classification gives a fair insight into the different states that may lead to the production of this somewhat unusual symptom. (*a*) Of those cases where no external manifestation accompanies the occurrence of "Mittelschmerz," the explanation may be that in these cases ovulation and menstruation do not occur simultaneously; and that, in addition, from thickening of the capsule of the ovary or some such cause, dehiscence of the follicle is attended with pain. (*b*) Those associated with escape of blood. In all of these it will be observed that more or less endometritis, anteflexion, and enlargement of the uterus were present; and, so far as I am able to judge, these were simply cases in which a slight intermenstrual flow, due to endometritis, was accompanied by well-marked pain during the passage of clots. Such a condition is well recognised and common, and scarcely, I think, should come under the category of "Mittelschmerz" at all. Still, it adequately enough describes a set of cases to which the Germans especially have drawn attention. (*c*) Lastly, in those cases in which a leucorrhœal discharge occurs with the "Mittelschmerz," and in which, just before the usual date of the occurrence of the pain, a swollen and fluctuating condition of the tubes was in some cases made out; I think there can be no question that the cause of the intermenstrual pain was to be found intermitting in hydrops Fallopii, reaching its full development at mid-term.

THE MENOPAUSE.—Although the menopause would appear at first sight scarcely to come under the category of diseases of menstruation, yet the changes and complications which occur at that period naturally fall to be described here.

First of all, pre-eminently, the menopause is associated with hæmorrhage.

Secondly, it is associated with the development of neoplasms.

Thirdly, it is associated with various sensory and vaso-motor changes.

Fourthly, the period immediately succeeding it, known as the post-climateric period, is a time when various morbid conditions are apt to occur.

The active period of a woman's menstrual life lasts on an average for thirty years. During that period the function is performed with more or less regularity, and at some time between forty-four and fifty the function lapses into abeyance.

Limits of Fertility.—With the occurrence of the menopause, the fertile period of a woman's life ceases; and here the question naturally occurs, what is the extreme limit of fertility in a woman? It may be safely said that the laws of physiology, the experience of mankind, and the decision of the law courts, do not warrant pregnancy after fifty-three years of age. Many cases of later pregnancy have been recorded, but these were before the days of parish registers, when verification of the age could not be secured.

Manner of Cessation.—The onset of the menopause varies under varying conditions, but the manner in which menstruation ultimately stops may be divided into three varieties:—

First, where it ceases gradually, getting month by month less and less, until it ultimately ceases altogether.

Secondly, where it ceases by irregular hæmorrhages, lapses of one or two months, and then a recurrence associated with more or less severe hæmorrhages; and

Thirdly, that variety, fortunately rare, in which it ceases suddenly.

Of the three modes of cessation, the first is probably the most natural and the safest, but the second is certainly the most common.

Local Changes.—The atrophic changes which take place in the organs consequent upon the menopause, and which become more pronounced as age advances, are:—The uterus shrinks, the muscular tissue partly disappears, and the walls become thinner; the uterine cavity is shortened, the uterine tissue becomes softened and relaxed; the mucosa is thinner and the vessels become friable; the fornices are obliterated, the cervix shrinks and no longer projects from the vaginal wall. According to Hennich, 28 per cent of women above fifty years of age have atresia of the cervix. This senile atresia of the cervical canal is no doubt the result of partial chronic endometritis, which is quite the normal condition after the menopause. Sometimes this endometritis is exaggerated, and there is an accumulation of mucus above the obstruction. The ovaries shrink and become cirrhotic, and the Graafian follicles disappear. According to Otroschkevitch, the lessening of both ovaries in old age arises in connection with the increased growth of fibrous connective tissue and the predominance of this over the degenerating follicles. There is also as age advances degeneration of the arteries and fibrous tissue. The vagina is shortened, narrowed, and becomes less elastic, and there is conditional senile colpitis, in which the epithelium is shed in patches; and, according to Hildebrandt, the raw surfaces produced by the loss of epithelium are apt to adhere together. The fat disappears also from the vulva and labia majora, and the labia minora shrink.

Effects in the economy.—It must be perfectly obvious that a function which has continued for thirty years with varying regularity must, on its cessation, produce symptoms more or less accentuated in a woman's system. It is impossible that the transition from active utero-ovarian life to sexual degeneration can be effected without some marked disturbances. These symptoms are, as far as the general economy is concerned, nervous and vaso-motor; but locally there is also determination of blood at irregular intervals to the various organs, resulting occasionally in local apoplexies, congestion of the ovaries, growth of uterine fibroids or polypi, and the commencement of malignant disease.

Symptoms.—The symptoms mainly are:—marked nervous disturbances, palpitation, heats and flushings, headaches, vertigo, tendency to obesity, and various psychoses, especially depression of spirits and melancholia, despondency, curious will disturbances, waywardness, and intellectual and emotional aberration.

Treatment.—In the management of the health at this time of life, four things ought to be specially attended to:—

First, and mainly, the avoidance of all stimulants, especially alcohol, for there can be no doubt whatever that there are more risks at this time of life than at any other, and that the terrible effects of alcohol are seen more at the menopause that at any other time in a woman's life. She should be encouraged to think that the symptoms will pass off, and pass off quicker without the use of any stimulants whatever. The temptation to take alcohol at that time of life is very great, and therefore it ought to be strictly interdicted in any form whatever.

Secondly, the use of saline purgatives ought to be encouraged.

Thirdly, the nervous system ought to be regulated by means of bromide, belladonna, and so forth.

Lastly, fresh air and freedom from worry and anxiety are essential.

Post-climateric discharges.—There can be no dictum more absolute than that after the menopause is once established any return of hæmorrhage is to be regarded very gravely, and this point cannot be too strongly emphasised. Any post-climateric hæmorrhage is always to be regarded as serious; and any woman, whether married or single, complaining of such hæmorrhages, ought to be subjected to a most careful local examination. I think it may be safely said that these post-climateric discharges are mainly due to one or other of the following conditions:—

First, to cancer of either the cervix or body.

Second, to the recrudescence of a fibroid.

Third, to senile uterine catarrh; and

Lastly, to a gouty diathesis.

Artificial Menopause.—In cases of persistent hæmorrhage due to fibroid tumours and such-like, the menopause can be induced by the removal of the uterine appendages; and such an artificially induced menopause gives rise to the same symptoms as those described when the menopause occurs at the ordinary time. Allusion has already been made to this matter under heading Amenorrhœa. The climateric symptoms are much more severe after double oophorectomy than after hysterectomy where the ovaries have been left; and this is probably accounted for by the want in the system of the internal secretion of the ovary; in many cases the symptoms have been greatly mitigated by the administration of tabloids of ovarian tissue.

Early and Late Menopause.—An early menopause is often established as the result of mental shock. Wasting disease, such as phthisis, mental strain, and such-like conditions, bring about a premature atrophy of the ovaries; whereas delayed menopause, already referred to, is characteristic specially of the gouty and those who suffer from fibroid tumours.

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STERILITY

E scope of the following article has been expressly limited by uest to the practical aspect of the subject. I must refer readers who are interested in the scientific relations of the question to the numerous treatises on sterility in which its various aspects are debated.

Sterility may come before the notice of the doctor in a variety of ways. In the first place, it may be the actual matter about which his advice is sought; in the second place, it may be incidentally complained of; and in the third place, it may not be complained of by the patient at all, but may be an element in the case which strikes the doctor.

Until comparatively recent years it has been taken for granted that sterility was always the fault of the woman, except in cases in which impotence, or at least sexual feebleness was apparent in the male. This is now known to be incorrect, and the fertility of the male can no longer be taken for granted; in other words, "potentia generandi" is no longer taken as implied in "potentia coeundi." As this article, however, concerns only female sterility, the question of male sterility will be touched on but slightly. Further, the sterility here considered will be limited to absolute sterility, *i.e.* absolute failure of conception; and the question of relative sterility will be dismissed with a few words on one example of it only, namely, that which concerns the limitation of offspring by artificial means. It not unfrequently happens that this enters essentially into the pathology of a case.

In the first place, sterility may be the direct cause of ill-health, and especially of marked nervous irritability, conditions which suggest inquiries on the subject. Then the reproductive rhythm may be such as to raise suspicion in the practitioner's mind. When, for instance, a child is born within a year after marriage, and then years pass without another pregnancy, it is important to ascertain whether the confinement and puerperium were normal, or whether the patient was the subject, perhaps, of a pelvic inflammation, which may have prevented future pregnancies. The question, "Why have you had no more pregnancies?" will generally elicit the answer, "I am sure I do not know," or "We did not want any more."

The question of the birth-rate is one of national importance. A high birth-rate with a high immature death-rate is of no service to a nation; but a large population cannot well be produced by a low birth-rate. It is also a matter of great importance by what section of the people the next generation is principally supplied. The present state of our civilisation, in which the indigent are no worse off if they have large families, while the middle, and especially the lower middle, classes are heavily taxed, seems to encourage the production of children whose parents are too poor and too ignorant to bring them up properly, and to discourage their production by those of a higher grade This would probably lead to a more serious substitution of the inferior for the superior, were it not for the very high infant mortality which exists among the indigent. It is hardly to be wondered at that when a large family means, say to a poor clerk, a larger house implying larger rates—by which he is taxed for the benefit of those socially below him—and inability to pay his way, he shrinks from incurring this burden. The present arrangement, by which a good citizen is taxed for the benefit of those who shirk one of the chief duties of a good citizen, is surely unfair.

It would seem advisable that, if ever Parliament has time again to turn its attention to matters which are for the benefit of the nation rather than of a party, our statesmen should consider whether some encouragement should not be given to the fathers of families who had brought up a certain number of children to a certain age, by lightening the burden of their municipal contributions or otherwise.

It must not be hastily concluded that in all cases where the production of children ceases, artificial means have been used, for the writer knows many instances of parents consenting to live apart as they were unable to support more children. To this, many of the arguments against artificial prevention do not apply; and yet the loss to the State is the same. Moreover, it is in itself an unnatural and dangerous arrangement.

It may be well to begin with a typical example of sterility. A woman consults the doctor because she has never conceived. He should inquire her age; how long she has been married; her menstrual history, as regards regularity, quantity, quality, and pain. He may find that she has severe dysmenorrhœa. Then it is proper to inquire as to the number of her relations, for her sterility may be merely the sign of a failing race. A patient will sometimes give the doctor useful information if he asks such a question as, "Have you any idea why you have never conceived?" or "Is your married life quite satisfactory so far as you know?" Questions of this kind are, in the writer's experience, quite frankly answered, as a rule, if they are asked straightforwardly, and the motto of the Order of the Garter, "Honi soit qui mal y pense," applies.

It then becomes the duty of the practitioner to carefully examine the reproductive organs; in the first place, the vaginal orifice. Has marriage been consummated? Is the vaginal orifice thoroughly dilated? It is surprising how often this gross defect is found even years after marriage, and often quite unsuspected by either party. The development of the pelvic organs may be deficient. This may be shown not only by the small size of the uterus, but by asymmetry of its surroundings, as, for instance, by an excentric position of the cervix, to one or other side, or too far back, implying shortness of a broad or sacro-uterine ligament. A conical cervix is often associated with this defect. The presence of a fibroid tumour of the uterus would also account for sterility, and need not cause any symptoms, though disorders of menstruation accompany a large proportion of such growths. In perhaps the majority of cases of sterility for which a doctor is consulted, no palpable cause can be discovered on physical examination.

Before giving advice in such a case, it is important to see the husband also. This is a matter on which experience has led me to lay more and more stress. In such a matter as sterility nothing can be taken for granted, not even that the husband possesses the most elementary knowledge of his duties. In these circumstances the plight of the married couple is not only lamentable but absurd. The medical man will, if he is fit to deal with such cases at all, have no difficulty in ascertaining the facts, and in giving the necessary instruction. In some cases this is all that is required for the "cure of sterility." In other cases "potentia coeundi" is normal, but coitus is too frequent. This should be corrected, and a limit, such as the traditional "bis in septem diebus," put.

In a good many cases inquiries will show that the husband has suffered before marriage from gonorrhœa, followed by orchitis. In such cases, and indeed in all cases where some gross defect is not the obvious impediment, the semen should be examined. My own practice is to delegate this examination, and the examination of the husband generally, to another expert; but though this is perhaps the pleasanter plan it is by no means essential, and both parties may, if preferred, be examined by the same person. The semen should be kept warm and examined as soon after its emission as possible. The spermatozoa may be absent, few, ill-formed; or they may be normal. Practically they are seldom moving when seen. This examination, which is of comparatively recent introduction, is becoming recognised by the public, and will be, perhaps, before long expected by them. Many, however, are still unaware that a man who is sexually vigorous is ever barren.

It is practically of great importance to get this point settled, not only to prevent unreasonable expectations, but also to defend the wife from local treatment which can do nothing but harm. Indeed, it is not very uncommon to find that the patient has wandered from doctor to doctor, that one operation after another has been performed, and that the patient's pelvis is matted with inflammatory remains, making conception hopeless in any case, while the idea of the husband's sterility has never been entertained.

After these few words of introduction, it will be well to review briefly the principal causes of sterility.

Sterility may be classified as follows:—

CAUSES IN THE MALE.—1. *Age.* 2. *Structural Causes:* (*a*) congenital malformations; (*b*) acquired structural defects. 3. *Functional Causes.*

CONCERNING BOTH SEXES.—"Incompatibility."

CAUSES IN THE FEMALE.—1. *Age.* 2. *Structural Causes:* (*a*) congenital malformations; (*b*) acquired structural defects. 3. *Functional Causes.*

CAUSES IN THE MALE.—1. *Age*—After maturity the male may remain fertile to almost any age, and age is more likely to produce impotence than sterility.

2. *Structural*—(*a*) Congenital malformations. The cases in which congenital malformations are the cause of male sterility in married life are few, because few men marry without advice under such circumstances. Among congenital deformities should be mentioned epispadias, which generally causes sterility, and hypospadias, which generally does not. Excessive or inadequate development of the penis need only be mentioned.

(*b*) Acquired structural defects. The commonest of these is probably the result of gonorrhœa, extending particularly to the epididymis, and so damaging its epithelial lining that spermatozoa are no longer produced, or if produced are imperfectly developed, motionless, and functionless; or the duct may be actually occluded. Again, apart from disease, the semen may be without spermatozoa, with few spermatozoa, or with motionless spermatozoa. According to Gross sterility is due to the male about once in six cases. Damage done by gonorrhœa is most likely to be permanent, but the character of the spermatozoa may improve with improved health in rare cases. Complete absence of semen, which rarely occurs, needs only to be mentioned.

3. *Functional Causes.*—A man may for a time be impotent, though well formed. I have known such cases, in which a young and vigorous man, used to sexual intercourse, has become impotent after marriage from sheer nervousness. This generally comes right very shortly, and remains so ever after. Such cases are not very uncommon. In some cases a temporary separation helps matters. The quality of the semen may deteriorate from too frequent intercourse, which is apt thus to defeat its own object. It is also true, I believe, that too infrequent intercourse is apt to lead to the same result, especially as regards the first pregnancy. Coition is a new function, certainly on the part of the woman, in most cases; it probably has its own mechanism, and the organs concerned have to get used to their functions. When pregnancy does not ensue it is well to give directions on this point, and to limit the occurrence to twice in the week or to prescribe this frequency.

In a remarkable case which lately came under my notice a young and healthy man married a young and healthy woman; he had been chaste before marriage, and was indeed ignorant of sexual matters till then; he had never masturbated. But he either failed to penetrate, or, if he penetrated, he failed to emit semen; moreover, he had spontaneous emissions. He was given arsenic and strychnine without result, but suddenly became normal, and begot a fine child at once.

"INCOMPATIBILITY" (concerning both sexes).—It sometimes happens that two persons, each of whom has been or later becomes fertile with some one else, are sterile together. The classical example is that of Napoleon I. His first wife—the Empress Josephine—had had a son by her former husband, the Vicomte de Beauharnais; but to Napoleon she was sterile. Napoleon, on the other hand, though incapable of impregnating Josephine, had a son by his second wife, the Archduchess Marie Louise of Austria. This instance, however, is not convincing, inasmuch as there is nothing to prove that Josephine was capable of conceiving when she married Napoleon; she may have suffered from some such affection as pelvic inflammation after her first confinement.

CAUSES IN THE FEMALE.—1. *Age.*—It is, of course, well known that pregnancy does not occur in women except between certain limits of age, within which they are, but outside of which they are not, capable of conceiving. But apart from this it has been shown by Matthews Duncan that the age at which a woman marries has a strong influence on the question whether she will or will not bear children. In his investigation on this subject (*Fecundity, Fertility, and Sterility*, 1871, p. 199) he found "that about 7 per cent of all the marriages between fifteen and nineteen years of age inclusive, and as they occur in our population, are without offspring; that those married at ages from twenty to twenty-four inclusive are almost all fertile; and that after that age sterility gradually increases according to the greater age at the time of marriage."

2. *Structural.*—(*a*) Congenital malformations.—Among these may be mentioned tumours or hypertrophies of the external genital organs; so-called imperforate hymen; malformations of the vagina, such as its partial or complete absence; absence or malformation of the uterus; absence or functionlessness of the ovaries.

The commonest of these is some slight abnormality of the hymen; either it is too tough or its orifice is too small. The former condition requires no explanation; the latter perhaps requires a word. The mechanical obstacle presented by a hymen with too minute an opening is the same as that presented to the fœtal head in labour by too small an orifice of the genital canal. In the usual mechanism this orifice is not too small for a small part of the fœtal occiput to engage it; it does so engage it, and the conical shape of the head gradually dilates it. Where the vulva, however, is so abnormally small as to prevent any part of the head from engaging it, the head cannot dilate it, but the whole perineum is greatly stretched and carried bodily in front of the head; in such cases central rupture may result. In the same way, if the orifice in the hymen is too small to admit any part of the glans penis, the hymen may be carried bodily inwards, but remains intact, or central rupture may result from great violence.

This applies to other deformities of the hymen, such as cribriform perforation, and the presence of a pair of small duct-like openings (sometimes associated with other deformities within the pelvis). In the latter case the hymen may be unusually elastic, and I have seen a case in which it could be pressed two inches or more within the vaginal orifice, neither husband nor wife being aware of the defect.

It will perhaps be well in this place to say a word about the alleged influence of "stenosis." A "pinhole os" is a very commonly alleged cause of sterility. In the first place this name is applied to cases in which the size of the os externum far exceeds that of any known pin. In the second place the alleged connection between stenosis and sterility is that of deficient size, preventing the entrance of spermatozoa. This explanation is quite untenable, for spermatozoa are microscopic bodies; however small the os externum may be, it is never as small as the uterine orifice of the Fallopian tube. Again, although an unruptured hymen or a malformed vagina with a very minute orifice generally prevents impregnation, most practitioners of large experience have seen cases in which pregnancy has occurred under both the above conditions. I have myself seen pregnancy repeatedly under such circumstances, and at the time of labour the orifice through which impregnation occurred is sometimes closed so absolutely as to admit no escape of fluid.

Stenosis is not capable of acting in the manner popularly supposed. There is, however, some connection between a conical cervix—which is generally associated with small size of the os externum—and sterility. The real fact appears to be that a uterus misshapen in this manner is an ill-developed organ, and therefore less likely to conceive. Such cases are sometimes associated with excentric position of the uterus due to defective development of its ligaments, and this is again a sign of malformation.

Displacements.—The claim that displacements of the uterus are a cause of sterility practically stands or falls with the effects of anteflexion, which is by far the commonest so-called displacement associated with sterility. The real fact is that anteflexion is the commonest condition of the nulliparous uterus, and is to a certain extent a sign of nulliparity. All women are sterile in a sense till they become pregnant, and some two-thirds of them have anteflexion. When they have borne a child the shape of the uterus is apt to change, and there is no longer sterility. But anteflexion is in no other sense associated with sterility, and should not be treated. To illustrate this point it may be said that the absence of striæ on the abdomen is also a cause of sterility because, generally speaking, women who have no striæ have borne no children. When they have become pregnant, and the pregnancy has progressed to a certain point, the striæ appear. Should we then score the abdomen with a knife to produce pregnancy?

(*b*) Acquired structural defects.—Acquired structural defects are most commonly the result of inflammation. *Perimetritis* may encapsule the ovaries, preventing the escape of ova, or may cause changes in the cortex of the ovary, interfering with the proper development of the Graafian follicles, or it may occlude the fimbriated extremity of the Fallopian tube. It is only when both sides are involved that sterility necessarily results. Though on clinical examination many cases of sterility (primary or acquired) appear to have one side only affected, it is probable that both sides are really affected in such cases. Sepsis and gonorrhœa are commonest causes of such inflammation.

Among other acquired defects may be named *occlusion* of some part of the genital tract, usually the vagina, after sloughing.

Fibroids often produce sterility. There are several reasons for this—viz. the bleeding from submucous fibroids, the catarrh often associated with them, and the endometritis which is often present. In addition it is very likely that the mechanism of impregnation is interfered with. A good many women, however, with fibroids do become pregnant.

Endometritis—a word which comprises many different abnormal conditions of the uterine mucous membrane, and is indeed applied very loosely—may be a cause of sterility. It is generally treated by curetting, and this is often followed by pregnancy; but so also is mere dilatation of the cervix.

3. *Functional Causes.*—It is true that a woman in whom no structural defect can be found may be sterile to a man who has recently had children by another woman (and may have others subsequently), or whose semen seems perfect—and that in spite of normal conjugal relations. The relation of the sexual orgasm in the female to impregnation has been the subject of debate. But it is certainly true that women entirely unconscious of any sexual feeling sometimes have large families.

It is probable that there is a certain mechanism of impregnation consisting in a contraction of the uterus followed by relaxation, which has the effect of drawing up the semen into the uterus. But, apart from this, spermatozoa travel by their own exertions, and are quite capable of making their own way into the uterus and tubes. This must, indeed, be the manner of impregnation when it occurs with an unruptured hymen or with a nearly occluded vagina with only a small orifice.

On the other hand, cases have been recorded in which pregnancy has only occurred when sexual feelings have been present; but it must be remembered that the mechanism of impregnation may act normally apart from conscious sexual feelings.

Profluvium seminis is an alleged cause of sterility. It is quite true that a very minute quantity of semen is sufficient to cause pregnancy; it is also true that some women in whom the semen escapes largely after coition become pregnant. Still it is a fact that marked profluvium is regarded by women as abnormal, and that it does not occur as a rule in fertile women. This lends weight to the view that the uterus normally aspires the semen during coitus. Cases occur in which profluvium occurs as a new symptom, with loss of sexual feeling and with acquired sterility.

The relation between *dyspareunia* and sterility is obvious. If coition is never complete, no explanation is necessary. If it is complete, though painful, it is possible that sterility may be due to failure of the mechanism of impregnation associated with the absence of sexual feeling.

The relation between *dysmenorrhœa* and sterility is undoubted, but its explanation is not obvious. The popular idea that the "os is so small that the menstrual blood cannot get out, and that the spermatozoa cannot get in" is absurd. One drop of blood passing every three minutes gives the rate of the average quantity lost at a menstrual period. What diameter is needed for this? The size of orifice required for the passage of the spermatozoa is certainly not larger than that of the uterine orifice of the Fallopian tube, which only admits a bristle.

Typical spasmodic dysmenorrhœa is really a uterine colic, in which regular rhythmical contractions which are painless are replaced by irregular arrhythmical contractions which are painful. Arrhythmical contractions may affect the mechanism of impregnation. As a fact the cure of the dysmenorrhœa is very commonly followed by the cure of the sterility.

The effect of the *general health* cannot be estimated. Matthews Duncan relates a case in which alcoholism appeared to have caused sterility, for it ceased when the patient became a teetotaller.

Obesity is certainly often associated in animals with sterility, just as overgrowth of branches and leaves in plants is often associated with sterility,—the absence of flowers and fruit,—and the arrest of growth (as by pruning or cutting roots) tends to produce fertility. This has been expressed as the antagonism between growth and genesis, or nutrition and genesis. There is reason to believe that obesity has some relation to sterility in women, though it is quite true that many very fat women are fertile.

Treatment.—1. *In the male.*—Congenital malformations may in some cases be remedied by surgical operations; male sterility from gonorrhœa is generally incurable, and yet this may not always be the case. In the absence of such a cause, general treatment may improve the quality of the semen; I have known it improve.

Temporary impotence may be removed by temporary separation; and also sometimes by strict prohibition of intercourse. It is in human nature to rebel and break through prohibitions, Q.E.F. In some cases the frequency of coition must be regulated.

2. *In the female.*—Age cannot be remedied, nor can marriages after the most favourable age (20 to 24) be forbidden; but premature marriages should be discouraged. As a matter of fact women are tending in England to marry late rather than early.

Congenital malformations can in many cases be remedied; tumours and hypertrophies can be removed, so-called imperforate hymen can be rendered patent. In the case of partial or complete absence of the vagina it is generally best not to attempt to make an artificial vagina, as it only leads to disappointment. It is easy to tunnel through the tissues to the uterus and call the passage a vagina, but in most cases it simply closes up again unless perpetually kept open by dilators, and this is rarely persisted in by the patient. In cases where there is sufficient vaginal wall to line the new canal in the course of the plastic operation, better results may be obtained. In many cases, however, the best course is to obtain a decree of nullity of marriage before too much time elapses.

In cases of unruptured hymen the same consideration obtains; its presence suggests the impotence of the husband, and, if this is the real explanation, no operation should be done on the hymen which would destroy the evidence that marriage has not been consummated. In cases where there is no question of nullity of marriage, and where the hymen is abnormal, the vaginal orifice can be dilated under an anæsthetic. Dilatation is far better than excision of the hymen, which really does not answer the purpose. Where vaginismus is present, dilatation under an anæsthetic may well be followed by the use of a glass dilator with or without the aid of cocain. The best way of using the cocain is to apply it in a 10 per cent solution on a strip of lint passed just within the vaginal orifice a quarter of an hour before the vagina is dilated either by natural or artificial means. In these cases sexual feeling is almost necessarily absent, and the secretion of the vulvo-vaginal glands (which exudes during sexual excitement) does not lubricate the vaginal orifice. For this vaseline is the best substitute. The glass dilator should be used once or twice daily, and in many cases familiarity breeds contempt and the vaginismus disappears.

What has been said above under the head of "stenosis" is sufficient to show that small size of the canal, even when associated with sterility, is not its cause, and the explanation to be given to women ought not to be that they are "too small."

The same argument applies to displacements. No displacement, as such, is a cause of sterility. "Forward displacements" are displacements only in name, and are really the best position for the uterus. Backward displacements are either congenital or acquired. When congenital they are usually associated with shortness of the sacro-uterine ligaments, and are thus a variety of congenital deformity, which may be itself associated with sterility. In this case, however, the displacement is the sign of another condition (congenital malformation) rather than itself the cause of sterility, nor does reposition of such a uterus remedy the defect, which is developmental in origin. When backward displacements are acquired they are signs of the descent of the uterus, which is not directly a cause of sterility. A retroverted uterus, however, is sometimes tender, especially when the ovaries are prolapsed with it, and the dyspareunia caused by it may interfere with impregnation. Such a condition, however, is rare except after child-birth. Backward displacement causing dyspareunia can generally be easily remedied by a pessary.

The results of pelvic inflammation causing sterility are best treated by time, care of the bowels, hot douches, and especially by courses of treatment at such Spas as Woodhall and Kreuznach. In such cases early treatment, before the adhesions have time to become tough, offers the best prospect. The prognosis is always doubtful, but is not always desperate, and organs should not be needlessly removed.

The results of sloughing producing narrowing or occlusion of the vagina may or may not be amenable to surgical treatment.

The treatment of fibroids as a cause of sterility hardly comes into practical medicine.

Endometritis would be treated on its own merits; it often requires curetting, and this (or the necessary dilatation which accompanies it) often cures the sterility.

Sexual frigidity and profluvium seminis, which often go together, are sometimes removed by time, but are hardly amenable to medical treatment.

Sterility is often associated with dysmenorrhœa; the association probably consists in the absence of normal rhythmical contractions of the uterus which are painless, and in the presence of abnormal arrhythmical contractions which are painful; the peristalsis of the uterus being defective in the one case in the mechanism of impregnation, and in the other in that of menstruation. Dilatation of the cervical canal probably paralyses the irregular action and allows a normal and rhythmical action to take its place. Dilatation is best done under strict antiseptic precautions at one sitting, and requires an anæsthetic as the pain is great.

Care of the general health and the reduction of obesity come under the scope of general medicine.

F. H. CHAMPNEYS.

THE NERVOUS SYSTEM IN RELATION TO GYNÆCOLOGY

IN the study of gynæcology a cardinal factor, which is often underestimated and even altogether overlooked, is the highly sensitive nervous organisation of the female sex. The instability of the nervous system, especially in the sphere of the emotions, which distinguishes woman from man, influences the character and progress of all kinds of disease in women, but more especially diseases of the reproductive organs. This factor calls for very careful consideration.

Up to the time of puberty there is little difference between the sexes, either in health or in disease. Boys and girls will play together, work together, and associate generally in perfect equality; the qualities which distinguish one sex from the other being undeveloped. As soon, however, as the great function of menstruation is established, which is henceforth to influence the woman during the whole period of her sexual life, the entire system undergoes a marked change: the undeveloped child becomes a woman; her body undergoes characteristic modifications fully described in works on physiology or obstetrics; and with them are to be observed the not less important changes in character, and in the general development of the nervous system, which distinguish the woman from the girl. It is at this important time that the conduct of the health of the growing girl may influence for good or for evil the whole future of the woman. Judiciously managed, she may be so trained that she will be able to meet successfully the strain on her nervous system during her future life: the duties of a wife and mother, the struggle with domestic anxieties and worries, or the sorrows which are rarely altogether absent from the lot of mankind. Injudiciously managed at this important epoch, all those things, which the strong-bodied and healthy-minded woman may bear with no permanent bad results, will tell terribly upon her. She will have no stamina, no power of resistance; and she may become the wretched, broken-down invalid so often met with in the present day, especially in those ranks of life in which the evil effects of unbalanced culture are so frequently seen.

This being so, it may be well to preface what has to be said on the influence of the nervous system on gynæcology by a few words on the *education and training of girls* at and after the establishment of puberty. This is all the more necessary since the higher education of women has taken such enormous strides of late years that it is now regularly recognised, and almost universal. The "High Schools" for girls are to be met with everywhere, and the still more advanced colleges of the type of Girton and Newnham are rapidly increasing in number, and are full of students. The old-fashioned girls' boarding-schools, with their perfunctory education and their elegant accomplishments, are driven out of the field, and let me say at once that, with limitations which are essential because of the difference of sex which cannot be got over, the change is one which seems to me an enormous gain, and I write of it in no spirit of opposition. This statement is needful, since there is an unfortunate tendency on the part of many mistresses of high schools to listen to the warnings of medical men with incredulity, and to accuse them of narrow-mindedness and opposition, of which, as a matter of fact, the great majority of them are in no way guilty. The recognition of possible evils, and due warning against them, are neither the one nor the other.

The one great fault of those who manage these educational establishments is that they have too often started on the absolutely untenable idea that between the ages of 14 and 20 sex is of secondary importance. I know of no large school for girls where the menstrual function is systematically cared for and attended to. The contention is that there is no real difference between an adolescent man and woman; that what is good for one is good for the other; that the apparent differences are due to the evil customs of the past, which have denied to women the ambitions and advantages open to men, and that when a happier era is inaugurated these will disappear. If this be so, how comes it that while every physician of experience sees many cases of anæmia in girls, accompanied by amenorrhœa or menorrhagia, headaches, palpitations, emaciation, and all the familiar accompaniments of break-down, an analogous condition in a school-boy is so rare that we may well doubt if it is ever seen at all ?

These disorders certainly do not necessarily result from the work. The successes of women in the schools have been sufficient to prove that their capacity for intellectual work cannot be doubted for a moment. On the other hand, the man's work is safeguarded by an amount of physical exertion in the way of sport which serves to keep him in health. It is true that in university colleges and in a few girls' schools attention has been paid to this point of late; but in a perfunctory sort of way at the best. There may be a gymnasium, or some form of games; but while at a boys' school cricket and football are compulsory—to say nothing of the natural disposition of a boy to athletic pursuits—at a girls' school, exercise is optional; and if a pupil tending to ill-health avoids it, little or no attention is paid to the matter.

While it is questionable whether in boys' schools the attention given to exercise and athletics may not be excessive, in girls' schools it is, on the other hand, not nearly sufficient. And yet this is a fault which might be very easily remedied. It would not be difficult to make the games of girls' schools compulsory as they are in public schools for boys; there are many games admirably adapted for women, as, for example, golf, hockey, lawn-tennis, rowing where it is feasible, or, it may be, bicycling. Each of these exercises the muscles generally without the spasmodic efforts required in cricket or football, which may be too violent for some girls. The result when such games are freely used must be well known to all who have a knowledge of what a thoroughly healthy English girl may be.

It is an obvious corollary from what has been said, that it is the bounden duty of mistress, parent, and doctor to insist at once on the cessation of all severe study when any of the physical signs of illness, such as it is impossible to mistake, have shown themselves,—as, for example, chlorosis, amenorrhœa or menorrhagia, wasting, loss of appetite, and the like. In my judgment it is not work which hurts, but perseverance in work after nature has hung out its danger-signals—work in an unhealthy body; the attempt, in fact, to fight nature. Then, indeed, the careless, prejudiced, and unwise mistress or parent may well find out that the results of "over-pressure"—the very existence of which so many deny—are a stern reality, and may shatter the whole future of the girl.

In the present article we are not called upon so much to consider the subject of the nervous system in general, as its special influence on our work as gynæcologists. Still, the important question naturally suggests itself, Are morbid nervous states, of the type now generally known as neurasthenic, on the increase amongst us ? Or is their supposed prevalence due to more careful observation, and the recognition of conditions formerly unobserved, or not referred to their proper source?

To these questions it is not easy to give a satisfactory reply, for no definite statistics exist by which they can be settled. It is pretty certain that *morbid functional neuroses are far more common in the cultured and educated classes* than in the comparatively uneducated. This accounts for the absence of cases of advanced neurasthenia in our hospital wards and out-patient clinics in England. Such states are indeed almost limited to private practice among the upper classes of society;[1] and they may explain, to a great extent, the comparative neglect of such illnesses, all-important though they be, by our clinical teachers, whose material for instruction is chiefly, if not altogether, supplied by hospital patients. There can be no doubt that culture and education, leading to increased nerve stimulation, have taken enormous strides within the last fifty years. This has been well illustrated by Max Nordau in his remarkable work on *Degeneration*. "In 1840," he says, "there were in Europe 3000 kilometres of railway; in 1891 there were 218,000 kilometres. The number of travellers in 1840 in Germany, France, and England amounted to 2½ millions; in 1891 it was 614 millions. In Germany every inhabitant received in 1840, 8 letters; in 1888, 200 letters. In 1840 the post distributed in France 94 millions of letters, in England 277 millions; in 1881, 595 and 1299 millions respectively. In Germany in 1840, 305 newspapers were published; in 1891, 6800; in France 750 and 5782; and in England (1846) 551 and 2255. All activities, even the simplest, involve an effort of the nervous system and a wearing of tissue. In the last fifty years the population of Europe has not doubled, whereas the sum of its labours has increased tenfold, in parts even fiftyfold. Every civilised man furnishes at the present time from five to twenty-five times as much work as was demanded of him half a century ago."

It is reasonable to conclude that nervous break-down and morbid states of the nervous system of all kinds should increase *pari passu* with the increasing developments of nerve work referred to, and such is probably the case.

It is indeed likely that many illnesses, formerly misunderstood and neglected as being beyond the power of the practitioner to alleviate, are now referred to their proper cause, and correctly diagnosed. This is the view taken by Professor Allbutt, who contends that neurasthenia is not more frequent than it has been for some generations past, but that it is better understood. Every one will concede the correctness of his contention that the more a nervous system is worked the better it is for its owner, with the obvious reservation that this must be in a healthy body. As has already been pointed out, it is not work that seems to hurt, but work plus such conditions as physical frailty, worry, anxiety, and the like; and persisted in in spite of warning. It will probably be generally admitted that the conditions of modern society are such as to make this kind of addition to work of the nervous system increasingly common. It is remarkable, moreover, that this type of disease is far more frequently met with in what may be called the centres of nervous energy and strain. I have constantly observed that such cases are enormously more frequent in such centres of active work as Glasgow, Liverpool, Leeds, and Manchester, than in the comparatively idle and fashionable members of West End London society. This is borne out by the returns of the Registrar-General, which show that in the census year the death-rate from nervous diseases in London was only about 22 per 10,000 persons living, while it runs up to 28·6 for Lancashire, 29·5 for the West Riding, 31·8 in Leeds, 32·8 in Blackburn, 33·7 in Preston, and 34·5 in Sheffield. The reason of this is probably complex. It may be partly due to heredity, since patients from such places are generally the daughters of busy, active, pushing business men, who have been the architects of their own fortunes; it may be partly due to the fact that such patients live in an atmosphere of strain and bustle, in which vicissitudes of fortune are far from uncommon.

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[1] It must be remembered that at the time this article was written (1898) the late author had for a long time relinquished out-patient hospital practice, and the opinion he expressed must have been largely, though perhaps unconsciously, affected by the impressions gained in private practice. At the present time there is no doubt that neurasthenia is common both in women of the poorest classes, and in educated women who work for their living in circumstances far from luxurious. The subject is more fully discussed in the article on "Neurasthenia," *System of Medicine*, vol. viii. p. 134.—Ed.

Similarly these types of diseases are said to be much more frequent in such new and very "go ahead" countries as Australia and America; so much so, that neurasthenia has been by some described as the "American disease." It is often said that national peculiarities have a great deal to do with determining the liability to these illnesses. Thus it is remarkable how comparatively rare in this country are the aggravated types of hystero-neurosis (such as are apparently common enough in France, if we may judge by the writings of Charcot), accompanied by trance, contractures, and the like; and this may justly be attributed to the greater general excitability of French women. This disease is, however, very unlike general neurasthenia, which is certainly something altogether different from the so-called hysterical state, and is by no means necessarily—or even most frequently in my experience—met with in women of very excitable temperament; or at any rate not in idle and fanciful women; it is seen rather in women of more than average intellect, who have exhausted their nervous systems by undue strain or anxiety, and who have struggled with the early symptoms of "nerve-tire," and refused to take note of the signs of impending mischief.

Functional neuroses arise easily in women; they may assume tremendous proportions, and their growth may be readily fostered and encouraged until, like some noxious weed, they choke all health of body and mind. But it is not easy, when once they are fully established, to trace them to their source; and unless we get at all the "*fontes et origines mali*," which may differ much in different cases, any rational system of cure is practically impossible.

Broadly speaking, we may say that there are *two classes of cases* with which we have chiefly to deal:

1. We may have some definite uterine or pelvic lesion, which may be the starting-point of secondary reflex neurotic complications, and in these cases attention is mainly to be directed to the cure of the originating local complaint.

2. We may have a condition in which some local lesion, in itself of minor importance, may be found, or has been found. This, indeed, may even be only a secondary result of the general neurotic condition which is the dominant factor in the patient's health; and the treatment of it may not only be inadmissible but, injudiciously carried out, may be intensely prejudicial, and very gravely increase the general ill-health from which the patient suffers. As a further development of this, we may often meet with cases in which some definite existing local lesion very probably started the illness, but has in time either itself disappeared or become so over-shadowed by its own secondary consequences that the judicious practitioner will minimise any treatment of it as much as possible.

The importance of the first class of case is certainly very great, and deserves the most careful study on the part of the gynæcologist.

There can be little doubt that **secondary functional disturbance of remote organs very commonly originates in some definite morbid local condition of the uterus or ovaries,** the irritation being conducted along the ganglionic and spinal nervous system. Every practitioner is familiar with the influence of the reproductive system in producing such a disturbance of distant organs as the neuroses of pregnancy; not only the commonly observed morning sickness, which may run into uncontrollable and even fatal vomiting, but other neuroses of an obviously similar type, but less commonly recognised, as, for example, excessive salivation, cardiac disturbances, the so-called "lypothymia," or partial trance, and such well-marked mental conditions as extreme depression of spirits or insanity.

It is familiar to the gynæcologist that in many of these cases all general treatment fails, while local treatment, such as the application of carbolic acid or iodine to an inflamed or abraded cervix, or the lifting of a retroverted gravid uterus out of the pelvic cavity, may give relief at once.

That similar local irritations in the non-pregnant woman may set up marked distal disturbances is a fact which the general physician is very apt to overlook; hence many a sufferer has been uselessly treated by incessant drugging, whose symptoms would at once have disappeared if the coexisting uterine or ovarian irritation had been detected and relieved.

Of course it is imperative that care should be taken not to overlook any unsuspected source of illness of this kind. Should some obvious lesion be found—such, for example, as an enlarged uterus, a badly lacerated and everted cervix, profuse uterine or cervical catarrh, swollen and tender ovaries and tubes, well-marked flexion or version—then no judicious practitioner would fail to remedy it by appropriate treatment, the details of which are fully considered in the several articles of this work. Above all things, however, it is essential that there should be no mistake about this—that the lesion we are treating should be real, decided, and unmistakable, and that the local treatment should be judicious and minimised as much as possible. We shall presently have to dwell more particularly on the evil effects which in nervous and emotional women are apt to follow injudicious and too-frequently repeated local treatment.

There are two possible errors which may be made in connection with this matter. One is that a distinct local lesion, which is the originating cause of a secondary nervous disturbance, may be overlooked and not treated at all; and thus the nervous condition may be maintained. The other is that *exaggerated importance may be attached to some local lesion* which is detected; that the error of diagnosis may be accompanied by an error of judgment, and that much needless local treatment of what may be called the "tinkering" kind is adopted: thus the coexisting neurosis is aggravated. Both mistakes are serious ones; but I am constrained to say—and the more I see of neurotic women the more convinced I am—that the latter is much the more serious and common of the two. Nothing can be more deplorably bad for a nervous, emotional woman, whose general health is at a low ebb, than to have her attention constantly directed to her reproductive organs by vaginal examinations repeated two or three times a week, pessaries constantly introduced for "a slight displacement," the cervix frequently cauterised, or the endometrium curetted, and the like; and yet these are things one incessantly sees in cases in which, on examination, no definite reason for such interference is found to exist. No doubt it is generally done in good faith; but the results are often disastrous, and I feel it to be my duty to insist very emphatically on the necessity of carefulness in this direction.

These remarks apply more especially to cases of the second class referred to, in which we are justified in concluding that the local affection was either of secondary importance from the beginning, or has become so in consequence of long-existing bad bodily health and the supervention of a neurotic condition.

It is scarcely consistent with the limits of this paper, which specially contemplates the discussion of such neurotic complications as come under our observations as gynæcologists, to enter into a detailed description of the conditions known of late years as "neurasthenic"; these will naturally be more fully discussed under this head, *System of Medicine*, vol. viii. p. 134. Indeed they are protean in character, and in no two cases are the symptoms identical. This one might expect, as the main element in the morbid state we have to deal with is the unhealthy action of a subtle and invisible function, quite beyond those ready means of examination which we can apply to the heart, lungs, or digestive organs, but which influences any or all of them nevertheless. Hence the risk of mistaking such disturbances as, for example, insomnia, headache, spine-ache, palpitations, nausea, loss of appetite, and a host of other conditions, for diseased states of parts which, in themselves, may well be substantially healthy. Exactly the same error may be, and often is made with reference to apparent disorders of the reproductive system; in these we may find cessation or disorder of menstruation, some increase of discharges or secretions, uterine and ovarian pains and aches of various kinds, but yet no structural lesion of any real moment.

One permanent characteristic, however, is to be found in all cases of this sort which merits the most careful attention, and is constantly overlooked; this is *defective general nutrition*, involving, as this of course does, badly nourished and therefore imperfectly acting nerve centres, and, as a consequence, defective action of all the viscera supplied and controlled by them. This defect is, indeed, the key-note to the treatment of a large number of cases of ill-health in women, which are often associated with morbid conditions referable to the reproductive organs, but are quite incurable until the general nutrition and health of the patient is placed on a satisfactory basis. A woman has some headache, or other disturbance, and for this she is perhaps advised to rest. Gradually all healthy habits of body are dropped, one by one, until she hardly leaves her sofa, and takes no kind of exercise; as a consequence the appetite fails, less and less food is taken, and progressive emaciation and great general debility supervene, with all the well-known attendant symptoms of chronic invalidism. Or it may be that another type of defective nutrition shows itself, and the patient, while weak, a poor eater, invalided and sofa-ridden, becomes overburdened with an enormous deposit of fat in the subcutaneous tissues.

These are precisely the conditions in which emotional disturbances of the worst kind appear. Some injudicious relative or friend is rarely lacking in such a case who adds fuel to the fire by constant unwise nursing and unduly sympathetic attendance. In many instances, it is to be feared, the medical man, at his wits' end to do something, makes matters worse by constant visiting, endless talks as to symptoms, and incessant prescriptions in which the inevitable bromide and similar harmful drugs play a prominent part. It is a happy thing for his patient if amongst them narcotics have not found a place; too often chloral, sulphonal, morphia, and the like have been resorted to, until at last the patient may have insensibly sunk into the deplorable habits of a chloral or morphia taker.

This description, of course, refers to the case of the confirmed neurasthenic invalid so often to be seen. But short of so advanced a type of neurotic illness the gynæcologist cannot fail to call to mind numberless women on the down grade, who were drifting into some such state of chronic ill-health, the physical path to which is defective nutrition, and who could almost certainly have been arrested in their downward course if the real cause of their illness had been thoroughly appreciated and acted upon.

It follows from what has been said that, in the large majority of cases of narcotism coming under our observation in gynæcological practice, the main object of treatment should be to improve the general nutrition, and so to aim at better general health. How is this difficult task to be accomplished? It is far easier to point out how it is not to be done; and, unluckily, the path which certainly does not lead to success is the one most generally followed. It is certainly useless in a confirmed case of this kind to attempt to cure the patient by way of the chemist's shop. Gallons of physic have generally been swallowed by her already, and the judicious practitioner will not add to the number of useless or possibly harmful prescriptions which a patient of this kind invariably has to show. If the case be a comparatively mild one, a little common sense, a quality not too generally found in the regulation of the treatment of neurotics, may be all that is required. An endeavour to ascertain and remove any more immediate causes, if such exist, whether physical or mental; the insistence on a proper amount and quality of easily assimilated food; the removal from unwholesome domestic surroundings, which may be brought about by change of air and scene,—these, or similar prescriptions, which vary in accordance with the peculiarities of each individual case, may suffice to restore the patient to health, and give back to her the efficient control of her nervous system which she has lost.

In the more severe cases, in which the symptoms of neurasthenia are well marked and of long standing, something more definite is required to give the patient a fair chance of recovery. Here that combined attack on defective nutrition known of late years as the **"rest-cure,"** or **"The Weir Mitchell" treatment** (so called after the well-known American physician to whom we owe its introduction as a systematic method of treatment), may, in properly selected cases, prove an invaluable resource. Suffice it to say that, properly and judiciously carried out in well-selected cases, its results are most striking and satisfactory, and hundreds of women are now going about well and strong who but for this would still be the wretched invalids they formerly were.

As the present writer was mainly instrumental in introducing this method of treatment into Europe, he may perhaps be regarded as unduly prejudiced in its favour. He ventures, therefore, to quote the estimate formed of it by the late lamented American gynæcologist, Dr. Goodell, which was probably one of the very last things he ever wrote:—

> One of the grandest discoveries in the treatment of the nervous phase of women's diseases is the rest-cure, for which we owe a large debt of gratitude to Weir Mitchell. Formerly there were in every city, town, and hamlet, sofa-ridden and bed-ridden women who were doomed to helpless invalidism under the label of "weak spine," of "spinal irritation," of "irritable womb," or of "chronic ovaritis." So countless were these cases, in the young and in the old, in the married and in the single, in the fruitful and in the barren, so much misery was entailed on the sufferer and on her kin, so many homes were blighted, so powerless was the medical profession to give help, that the pathetic lament of the Hebrew prophet could not have been better applied than to this great and wide-spreading scourge, "Is there no balm in Gilead? Is there no

physician there? Why then is not the health of the daughter of my people recovered?" Yet now I think myself safe in the assertion that very few of these cases are incurable, and that no other discovery in medicine has raised so many women from their beds and restored them to lives of active usefulness. It is the miracle of modern therapeutics.

It is, however, essential that if treatment of this kind is to prove useful it should be adopted in properly chosen cases only, and that when it is attempted it should be done thoroughly and well. Constant failures arise from neglect of one or other of these points, especially of the latter. There is much that is disagreeable about this treatment, at least in appearance; especially the removal of the patient from her usual domestic surroundings, and her seclusion in a properly managed medical home. This is naturally disliked, and it leads to much expense. Pressure is, therefore, put on the medical man, to which he is often weak enough to yield, to treat the case in what is called "a modified way," by "trying a little massage" (this being one of the remedial agents) at the patient's own home, or in some other way to try to play "Hamlet" with the part of Hamlet left out. The inevitable consequence is failure and disappointment, a really good and valuable method of treatment is discredited, and the patient's state is made worse rather than better. I have seen so much of this that I cannot too urgently insist on the necessity of thoroughness in any attempt to carry out this means of cure.

An interesting question in relation to diseases of the nervous system in *gynæcology* arises in *connection with insanity*. Some have held that insanity may actually depend on morbid conditions of the reproductive organs; and it has even been suggested that for the cure of certain forms of insanity associated with pronounced sexual aberrations—such as excessive masturbation and erotic manifestations—the uterine appendages should be removed by operation. I have never been able to find any reliable evidence at all of this alleged connection. Of course insane women are liable to uterine disease as sane women are; and when they have marked disease of the reproductive organs, of whatever type, it should be appropriately treated, whatever the condition of the mental functions. Inasmuch as the medical staff of asylums are rarely expert in gynæcology, it is likely that where so many women are congregated together there may be found a considerable amount of undetected pelvic disease which should be made the subject of treatment.

In a paper on this subject Brown contends that fully 25 per cent of the female patients in asylums in the United States suffer from some form of pelvic disease. If this be true, it follows that alienist physicians should not neglect the study of gynæcology more than any other department of medicine. But while this may be admitted it does not follow that the one has any direct connection with the other. Unhappily it has been very common to revert in a haphazard way to *operative interference*, which, in my opinion, is unscientific, unnecessary, and often hurtful. The excessive masturbation and various erotic manifestations so common in certain types of insanity are, it cannot be reasonably doubted, phenomena of central, and not of peripheral origin; to remove the ovaries or tubes by way of curing them seems to be altogether unreasonable. It may be laid down as an axiom, which is consistent with the most generally received opinion of the profession, that no operation of this kind is permissible in an insane patient unless some structural lesion exist which would call for or justify the operation were the patient sane. Of the uselessness of such a procedure a marked example is given in Case IV. of Brown's paper above referred to.

This operation has also been recommended and performed in other forms of neurotic disease, in which, in my opinion, it is still less admissible. Of late years, unhappily, it has been a not uncommon practice in various intractable forms of functional neurosis to remove the uterine appendages, not because they showed any kind of structural disease, but because the neurotic condition had previously resisted all ordinary means of treatment. In a paper on this subject, published in the thirty-third volume of the *Obstetrical Transactions*, I have fully discussed this procedure, and have brought forward evidence to show its utter uselessness. It is impossible to speak too emphatically in condemnation of a rash and irretrievable experiment of this kind.

The only class of case in which such operations have any reasonable claim for consideration are those of hystero-epilepsy, or other very severe forms of nervous disease, which are regularly aggravated at the menstrual periods, and may therefore be assumed to be in some way connected with that function. It does not follow that because such cases are worse during menstruation, when all the bodily functions are naturally in a state of unstable equilibrium, that they depend upon it. Still the supposition that the artificial production of the menopause should have a curative effect in such cases is a sufficiently reasonable hypothesis, and it is not surprising that the operation should have been often performed in such cases. The records, however, are not satisfactory. Of the cases of this kind which have been published of late years, something like 50 per cent were complete failures; and even in a well-marked case the outcome of experience tends to show that operative interference should not be resorted to unless distinct evidence of coincident structural mischief exist.

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MALFORMATIONS OF THE GENITAL ORGANS IN WOMAN

Introduction.—The malformations of the female genital organs form a natural and sharply defined group of deformities whose special interest, from the gynæcological standpoint, lies in the effects which they produce upon the menstrual phenomena, and upon the sexual and reproductive life of the woman in whom they exist. These effects vary greatly in importance with the nature, position, and extent of the malformation; and also, doubtless, with the constitution of the patient and her condition as regards marriage. Manifestly the absence of the uterus is a more serious matter than the imperfect development of an ovary or a tube; and malformations which are of grave import in a married woman may exist without inconvenience in a spinster.

It will be convenient to consider, first, the malformations of individual organs, beginning with those of the ovaries, and dealing in turn with the Fallopian tubes, uterus, vagina, and vulva; I shall then discuss the abnormalities which affect more than one of the reproductive organs, including cases of hermaphroditism.

In studying these genital anomalies, it must not be forgotten that we are concerned with organs which are derived from at least three distinct sets of embryonic structures. As embryology is the true key to the understanding of the nature of malformations, it will be well if the reader will keep in mind its leading phases and phenomena as set forth in the article on the "Anatomy of the Female Pelvic Organs" (*vide* pp. 45-49).

The mode of development of the generative organs must be constantly borne in mind in the study of the malformations to which they are subject; for many of these are thus at once capable of explanation. Certain anomalies, it is true, admit of no such easy elucidation; nevertheless it is probable that a more exact knowledge of the early stages of development, when obtained, will serve to clear up what is at present obscure. F. von Winckel, in a most valuable work (*Ueber die Eintheilung, Entstehung, und Benennung der Bildungshemmungen der weiblichen Sexualorgane*, Leipzig, 1899), has divided the malformations of the uterus into seven groups according to the seven periods of development through which that organ passes. The first period corresponds to the first month of antenatal life, and its malformations comprise complete absence of uterus, vagina, and tubes, as well as the uterus unicornis; the second period (second month) has, as its special anomalies, the uterus duplex, the uterus solidus, the uterus rudimentarius, and the uterus unicornis cum rudimento cornu alterius; the third and fourth periods (third to fifth months of antenatal life) have the uterus bicornis septus, subseptus, and simplex, along with the uterus planifundalis and arcuatus; the fifth period (sixth month to full term) has the fœtal uterus as its special malformation; the sixth period (birth to tenth year) has the infantile uterus; and the seventh (tenth to sixteenth year) has the uterus membranaceus and the uterus inequalis.

MALFORMATIONS OF THE OVARIES.—It is only within recent years that special attention has been paid to ovarian anomalies, yet these disorders affect the sexual life and responsibilities of the woman, and may interfere with the success of such operations as oophorectomy or ovariotomy.

Pathology.—1. *Supernumerary Ovaries.*—It is well to reserve the term "supernumerary ovary" for such rare cases as that reported by Winckel, in which a third ovary lay in front of the uterus, to which it was attached by a strong ovarian ligament. It also formed connections with the bladder and with the right Fallopian tube. The two normal ovaries were of equal size, and there were no traces of peritonitis in their neighbourhood. The supernumerary ovary was twice the natural size. The patient, an old woman, was sterile, notwithstanding the abundance of ovarian tissue. No case exactly resembling Winckel's has yet been recorded, and the condition must be very rare. Embryology gives little help in solving its mode of origin. It may have been due to duplication of the sexual gland on one side; but Winckel suggests that it was developed from the *anlage* of the bladder (allantois), and that in this way its vesical attachment is explicable. Nagel doubts whether Winckel's case was a true instance of third ovary, for there were gland ducts in it.

2. *Accessory or Constricted Ovaries.*—Accessory ovaries differ greatly from the anomaly which has just been described. They are much less rare, for they are found in from two to three per cent of autopsies; they are rounded bodies always smaller than the normal ovary, to which they have a pediculated, rarely a sessile attachment near its peritoneal border; and they vary in number from one to three. In a case observed by J. D. Williams, and seen by myself, the accessory ovary was of the size of a large pea; it was made up of ovarian stroma with Graafian follicles, and was attached to the anterior border of the right ovary by a stalk which consisted partly of fibrous tissue, with an external coating of low cubical epithelium, and partly of solid columns of epithelial cells enclosed in the fibrous tissue. In the above case there had been dehiscence of at least one Graafian follicle, for a cicatrix was found. An accessory ovary may become cystic. Mr. Doran has pointed out that small fibromyomas may arise in the ovarian ligament, and be mistaken for accessory ovaries; but in most of the recorded cases there seems to have been little doubt of the glandular character of the bodies.

Accessory ovaries are probably constricted portions of the normal organ which have been separated at an early period in the development, possibly by the agency of fœtal peritonitis; in rare cases the ovary has even been found divided into two nearly equal parts by such a constriction. At the same time, traces of peritonitis are not always present, and then it is possible that the accessory glands were produced by a form of budding of the primitive sexual gland. This latter hypothesis is strengthened by the fact that in some instances the accessory ovary consisted entirely of Pflüger's tubes. It is also possible that cases of this kind may have given rise to the notion that both ovary and testicle were present in the same individual, the accessory ovary with its tubuliferous structure being regarded as a testicle.

3. *Hypertrophy of the Ovary.*—Occasionally, ovaries of twice the normal size have been found in the infant at birth. This may be due to hyperplasia of all the component parts of the gland; or to an increase in the connective tissue elements with destruction of the Graafian follicles, the result possibly of fœtal oophoritis. In twin-bearing women the ovaries, according to Hellin, contain an unusually large number of ovisacs, a persistence, in fact, of the fœtal character of the glands.

4. *Absence of the Ovaries.*—Complete absence of both ovaries, save in sympodial and acephalic fœtuses, is an exceedingly rare anomaly. It cannot be absolutely proven without a post-mortem examination of both pelvis and abdomen; for the glands may exist in a rudimentary state, or in an unusual position, and so clinically escape notice.

Absence of one ovary is also a rare defect, but its occurrence is well established. It is usually, but not invariably, associated with absence of the corresponding half of the uterus (*u. unicornis*), and of the tube of the same side; one kidney is also wanting in certain cases. It would seem, therefore, that defect of the sexual gland is apt to carry with it absence of the Müllerian and segmental ducts, and the Wolffian body.

5. *Rudimentary State of the Ovaries.*—This is much less rare than complete absence of one or both ovaries. The glands are small in size and may have either the fœtal or the adult form. Microscopically they may show no Graafian follicles; they may consist simply of connective tissue, with vessels and scanty muscular fibres, or they may exhibit a few ill-developed ovisacs in the midst of ovarian stroma. Sometimes by the persistence of Pflüger's tubes in an unclosed state they may simulate testicles. They may occupy their normal position; or, as in Blot's case, they may lie near the upper angle of the uterus; or, again, they may be found herniated in the inguinal canal. They may coexist with accessory ovaries, with rudimentary Fallopian tubes, with a bifid or fœtal uterus, and with stenosis of the aorta. At the same time the uterus may be normal and the ovaries rudimentary, and conversely. Such defects may be due to fœtal oophoritis or peritonitis, to torsion of the pedicle of the gland, or to arrested development.

6. *Displacement of the Ovaries.*—Non-descent of an ovary is a rare but not unknown anomaly. Mr. Bland-Sutton has reported a case in which

the right ovary was adherent to the lower border of the kidney of the same side, and I have seen a case in the new-born infant in which it was attached by peritonitic bands to the cæcum. It has been stated that it may be found free in the peritoneal cavity, or adherent to the omentum; it may then be cystic.

Instead of non-descent there may be dislocation of the ovary downwards into the inguinal canal. According to Puech, congenital inguinal hernia of the ovary is much more common than acquired, and Zinnis has recently reported an instance of it; but Bland-Sutton states that he knows of no case in which the ovarian nature of the herniated body has been proved by microscopical examination conducted by a competent observer. Herniation of the ovary, which may be unilateral or bilateral, is usually associated with displacement of the Fallopian tube; sometimes with malformation of the uterus and malposition of the kidney. It may be due to defective development of the round ligament and a patent condition of the canal of Nuck. A congenital crural, ovarian hernia has not yet been observed.

Clinical Features.—The presence of *supernumerary* or *accessory ovaries* is no guarantee of fertility; for in certain of the recorded cases the patients, although married, had not borne children. The woman seen by Olshausen, however, had had three confinements. Sterility in these cases may be accounted for by the cystic or atrophic state in which the ovaries, both normal and accessory, are often found; and possibly the fœtal peritonitis, which caused the division of the gland, led also to destruction of the ovisacs in it. In another direction, however, accessory ovaries have a certain clinical importance: their presence may explain the occasional persistence of menstruation after double ovariotomy or oophorectomy, as has been pointed out by Homans and others; the removal of three entirely separate ovarian cystomata or dermoids is rendered possible, as in Sippel's case; and the occurrence of pregnancy after a double ovariotomy finds a very probable explanation. Their diagnosis must always be a matter of great difficulty; but their occasional presence must be borne in mind when small bodies are felt in the pelvis near to, or even at some distance from the normal ovaries.

The clinical importance of *absence* or a *rudimentary state of the ovaries* depends greatly on the unilateral or bilateral character of the anomaly. If only one ovary be absent there may be no interference with the patient's reproductive power; for in the case reported by Busch, and quoted by Lawson Tait, the woman, notwithstanding unilateral absence of tube and ovary, had borne ten children. When, on the other hand, both ovaries are wanting or imperfect, indications of the defect are usually forthcoming at the time of puberty. Then there is an absence of the changes peculiar to this age, such as the establishment of the menstrual flow, the growth of hair on the mons veneris, and a rounding of the figure; the individual approximates rather to the male than to the female type, or possibly retains the characters of infancy, with or without idiocy or cretinism. Exceptions occur, however, in which the woman shows the normal female character and has active sexual desire. Epilepsy may occasionally appear at the period of puberty; Skene believes that defective development of the ovaries is of importance as a cause of mental weakness, and even of insanity; for normally the brain is stimulated to higher development by the demands of these organs. There would seem also to be more than an accidental connection between chlorosis and imperfectly formed ovaries. In adult life sterility is the constant result of a bilateral absence of the sexual glands; and it may be accompanied by the growth of hair on the face, and especially on the upper lip.

It is extremely difficult, if not impossible, to determine during life the existence of the ovarian defects under consideration: vaginal, rectal, and vesical touch, even when combined with abdominal palpation, often fail to establish the diagnosis; and nothing short of laparotomy gives certainty. Yet it is very important that the anomaly should be detected, or at least suspected, if only to save the patient and her medical attendant from the dissatisfaction and disappointment consequent upon the employment of a long and futile course of treatment for the establishment of menstruation by means of stem pessaries and the like. Even when fairly conclusive evidence of the rudimentary state of the ovaries exists it is by no means certain that the lesion is truly congenital, for scarlet fever and other zymotic affections occurring in childhood may lead to their injury.

Ovarian hernia is suggested by the presence of a rounded or oval body in the inguinal canal or labium majus, whether on one or both sides, when it occurs in an individual with a uterus and external genitals of the female type. For a certain diagnosis of the displaced gland microscopical examination is necessary, but the absence of the ovary from its normal position in the pelvis as determined by bimanual examination, the enlargement of the herniated body at the menstrual periods, and the existence of dysmenorrhœa and dyspareunia, usually justify the provisional diagnosis of inguinal ovarian displacement. It must be borne in mind that the dislocated gland may undergo cystic changes which will mask its true nature. With regard to treatment, attempts at reduction almost invariably fail; and palliative measures, such as wearing a hollow pad over the ovary, are to be preferred. When the gland becomes inflamed or cystic, ovariotomy will be necessary; but when it is healthy it ought not to be removed, for pregnancy has been known to occur even with double ovarian hernia.

MALFORMATIONS OF THE FALLOPIAN TUBES.—Since it has become customary to perform abdominal section for the relief of various morbid states of the viscera, attention has been more specially directed to the study of the malformations of the Fallopian tubes; and it is now known that these ducts may exhibit many anomalies with some of which earlier writers were unacquainted. The exact bearing of these abnormalities upon the physiology and pathology of reproduction is not fully determined; but there is reason to believe that ectopic pregnancy may, in some instances at least, be due to developmental errors in the tubes. Tubal anomalies, like those of ovaries, may be roughly classified into those of excessive formation, those of defect, and those of altered relation. These terms, however, must not be taken in a strictly literal sense.

Pathology.—1. *Supernumerary Fallopian Tubes.*—Examples of complete duplication of the tube, like genuine cases of supernumerary ovary, are extremely rare; the two conditions may be associated. Instances have been reported by Keppler, Falk, and Ruppolt; the last-named author was of opinion that in his case the tube and ovary had been divided into two parts by the action of fœtal peritonitis. In Wetherill's case some doubt must exist whether the tubes running in the ligamenta lata below the normal Fallopian tubes were really salpingeal in nature.

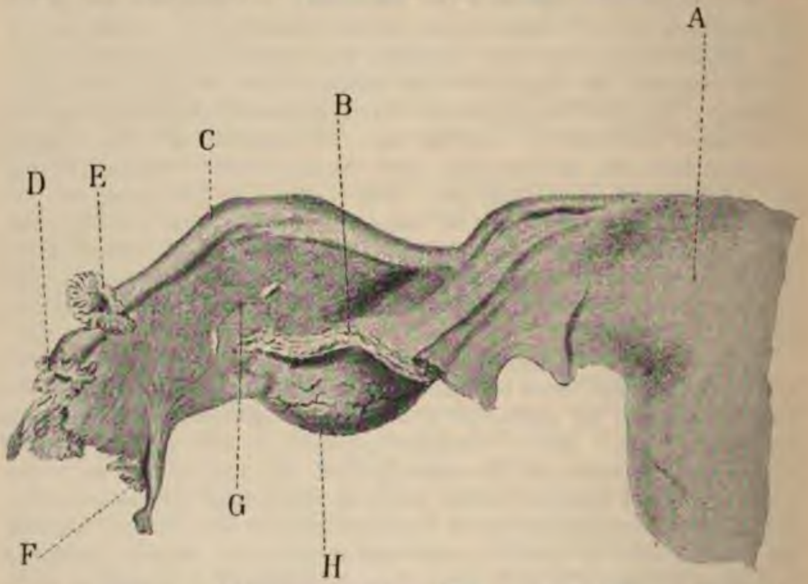

FIG. 45.—Anterior view of right uterine appendages, showing accessory abdominal ostium of tube. A, Uterus; B, cut surface of mesovarium; C, right Fallopian tube; D, fimbriated extremity; E, accessory ostium abdominale; F, free fold of anterior layer of mesosalpinx; G, pedunculated cyst; H, right ovary.

2. *Accessory Tubal Ostia and Tubes.*—Another tubal malformation, which may be reckoned among those "by excess," is the presence of accessory ostia or tubes. Opinions vary as to their frequency; Richard found them as often as five times in thirty cases; Kossmann noted them in from 4 to 10 per cent; and J. D. Williams and the present writer observed two examples in sixty-one consecutive autopsies (Fig. 45). From 3 to 6 per cent is doubtless the usual proportion. Until recently more than three accessory ostia on one tube had not been observed, and commonly

there are one or two only; but Ferraresi has put on record a remarkable case in which there were six. The ostia are either sessile or have pedicles consisting of accessory tubes; they are usually surrounded by fimbriæ. They are generally situated near the normal abdominal opening, and on the upper convex border of the tube; but sometimes they lie midway between the normal ostium and the uterine end of the oviduct. Usually they communicate with the tubal lumen. Mr. Doran explains the origin of accessory ostia by partial failure in the closure of the groove in the germinal epithelium which forms the upper part of the Müllerian duct; at the same time he thinks that they may also be due to splitting along the outer edge of Müller's duct after it has formed a closed tube. Kossmann, however, believes that they are occasioned by the existence of a supernumerary embryonic *anlage* (rudiment), lying parallel to the primary one.

3. *Tubal Appendages or Accessory Fimbriæ.*—Ferraresi gives the name tubal appendages ("appendici tubæ") to certain structures, not uncommonly met with, which may be identified with the "pedunculated tufts of fimbriæ" described by Mr. Bland-Sutton. Superficially they bear a resemblance to accessory ostia, but their stalk is solid, and they show no ostium. Ferraresi found them six times in forty cases, and when present they occupy the same positions as accessory ostia; two have been seen on the same tube. Bland-Sutton regards them as ruptured cysts of Kobelt's tubes; but more probably they have the same origin as the accessory fimbriated ostia.

4. *Anomalies in the Length of the Tubes.*—In cases of ovarian hernia the tube has often an unusual length. Even when there is no such displacement it may attain abnormal dimensions—16 to 17 cms. in length according to de Sinéty. The normal length is from 10 to 11 cms., and the longest tube met with by J. D. Williams and myself measured 14 cms.

The tubes may also be of unequal length—sometimes the right, and at other times the left being the longer. Winckel says, with regard to primary or congenital inequalities, that the embryonal causes may be an unequal length of the *anlage*, irregular position, restricted motion from the pressure of neighbouring organs, or increased traction from fœtal peritonitis.

5. *Absence of the Fallopian Tube.*—Absence of the tubes may be bilateral; but more frequently it is only unilateral. In the former case the defect is usually associated with absence of the uterus; whilst in the latter the uterus unicornis is commonly present, the uterine horn being absent on the same side as the tube. Colomiatti, however, has reported a case in which the vagina and uterus were well formed, and yet the right tube and ovary were absent. Unilateral defect of the tube usually carries with it absence of the ovary; but this is not invariable, for in Blot's specimen the gland was present but rudimentary. In certain instances the corresponding kidney is also wanting. The want of development of the upper part of Müller's duct is doubtless the cause of

the anomaly; when the whole duct is absent there is also a unicornute uterus.

6. *Rudimentary State of the Tubes.*—In rare cases the outer part of the tube is absent; thus, in a case of genital tuberculosis, J. D. Williams and the writer noted congenital absence of the outer two-thirds of the right oviduct, the inner third having a lumen and tapering to a point at its outer end (Fig. 46). In a post-mortem room specimen the late Sir T. Grainger Stewart observed that the tubes were shorter than normal, ended blindly, and were connected by bands with the peritoneum covering the rectum. Absence of the outer part of the tube does not necessarily carry with it defect of the corresponding ovary; but in the case seen by Marchand it did so. Doubtless the anomaly is due to fœtal peritonitis. Sometimes only the fimbriæ of the ostium abdominale are wanting.

Partial or complete absence of the normal tunnelling of the tubes may be met with; and then these organs are represented by solid cords of fibrous or muscular tissue. Sometimes it is at the abdominal end only that the tube is imperforate: in the case described by Dr. Haultain the outer extremity of one tube was quite smooth, like the finger of a glove; the tubal mucosa showed no folds, and the ovary on the same side was cirrhotic and cystic. Absence of the tubal lumen is simply the persistence of the normal condition in the embryo; an imperforate state of the ostium abdominale must be due to want of development of the Müllerian funnel which should open into the splanchnocele.

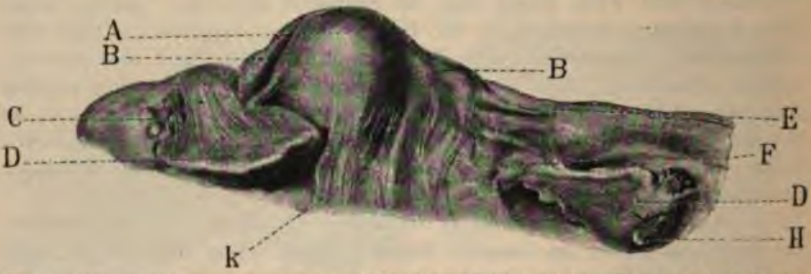

FIG. 46.—Congenital absence of outer two-thirds of right Fallopian tube. (Post. view.) A, Fundus uteri; B, B, tuberculous nodules in isthmus of each Fallopian tube; C, parovarian cysts; D, D, ovaries; E, cone-like end of right Fallopian tube, outer two-thirds being absent; F, cut margin of right mesosalpinx; H, fibroma of right ovary; K, adhesions on posterior wall of uterus.

During fœtal life the tubes normally exhibit spiral convolutions, both in the isthmus and ampulla; at birth these have disappeared in the isthmus, and in the adult they ought to be entirely absent. Sometimes, however, the convolutions persist, as in some of the specimens described by Popoff; but Haultain is of opinion that tubal contortion in the adult is more commonly due to a return to the fœtal state than to a persistence of it. If endosalpingitis occur in such a tube it is easy to understand how hydrosalpinx or pyosalpinx may be initiated.

7. *Displacement of the Tubes.*—It is stated that the tubes may show

an unusually low implantation into the uterus—a misplacement which has been regarded as one of the causes of placenta prævia. Displacement of the tubes in various directions may be the result of fœtal peritonitis, as in a specimen shown by myself to the Edinburgh Obstetrical Society; and in cases of ovarian hernia the tube usually accompanies the gland. A curious case of backward dislocation of the tubes, with union of their abdominal ostia to form a ring behind the uterus, was reported by Hüter; but some doubt existed as to the congenital nature of the anomaly. Pierre Wiart has reported the case of a six months child in whom the left tube was engaged in the abdominal opening of the inguinal canal: the ovary lay near the opening but did not engage in it.

8. *The Hydatid of Morgagni.*—This name is often loosely applied to pedunculated cysts arising from the curved tubules of Kobelt (parovarium), or to stalked terminal cysts of Gartner's duct; but it ought to be reserved for the much less common cyst which is found attached by a pedicle to the tube or to its fimbriæ. J. D. Williams and myself met with it in 8 per cent of the adult cases examined by us; it varies in size from that of a pea to a small bean; it is lined by a mucosa with simple folds covered by a single layer of ciliated columnar epithelial cells; its wall is always composed of muscular fibres arranged circularly and longitudinally; its outer membrane is the peritoneum; its stalk is always muscular; and its contents are clear, limpid fluid. Thus it may be distinguished from the false hydatids of Morgagni. It has been regarded as the remnant of the upper end of Müller's duct.

Clinical Features. — Malformations of the Fallopian tubes are seldom diagnosed during life. They may be discovered during the performance of laparotomy, or their existence may be suspected when anomalies of the uterus or ovaries are known to be present; but the symptoms to which they give rise are not distinctive, and the physical signs associated with them are most difficult of recognition.

Absence or *imperforate condition* of the tubes, if bilateral, will be the cause of sterility; and if in such cases the ovaries be present, the rupture of Graafian follicles and the discharge of ova into the abdominal cavity may occur at menstrual epochs, with the consequent formation of small hæmatoceles and the occurrence of localised peritonitic attacks. Unilateral absence or imperforation is not a bar to conception, for the tube of the opposite side may transmit the ovum to the uterus. Chavannaz, for instance, recorded the case of a woman of sixty, who had borne three children, and who yet possessed neither tube nor ovary on the right side. *Spirality* of the tubes or *displacement* may be causes of dysmenorrhœa and also of sterility. It has been thought that an *accessory ostium* may be a factor in the production of ectopic pregnancy. Henrotin and Herzog have reported two supposed cases of this: in one, the abdomen was opened for symptoms of tubal rupture, and below the right tube was found a small accessory tube with a sac in it containing blood clot, decidual cells, and chorionic villi; in the other there was a diverticulum projecting from the left Fallopian tube near its middle, which also contained decidual cells, chorionic villi, and blood clot. On the other hand, Sänger has recently shown that an accessory ostium may serve to give the ovum a means of access to the tube and uterus when the normal tubal openings are closed on both sides by inflammatory processes.

MALFORMATIONS OF THE ROUND AND BROAD LIGAMENTS.—Malformations of the round ligament are occasionally met with, but they have been little studied, and are doubtless commonly associated with abnormal states of the uterus, tubes, or ovaries. Persistence of the canal of Nuck, in which the ligament lies, gives rise to hydrocele in the woman. The broad ligaments, like the round, may be absent, rudimentary, or unequally developed. The ligamenta lata also may be congenitally displaced; and they often contain within their folds cysts which have developed in the mesonephric relics which form the organ of Rosenmüller or parovarium.

MALFORMATIONS OF THE UTERUS.—Malformations of the uterus form a large and interesting group of genital anomalies, the mode of origin and clinical manifestations of which have long been the subject of extended investigations. The various types of uterine anomaly are, therefore, well known: their pathogenesis is, with one or two exceptions, agreed upon, and their influence on the general and sexual health of the individual is, to a large extent, understood. Saint-Hilaire, Kussmaul, Fürst, Lefort, and Klebs have all by their researches greatly increased our knowledge of uterine malformations.

Winckel's method of classification of uterine anomalies has already been described (*vide* p. 129), but his scheme, although invaluable to the teratologist, deals too much with minor details for the practical purpose of the gynæcologist. It will be convenient simply to divide uterine anomalies, like those of the tubes and ovaries, into three groups: those in which there is apparent excessive formation, those in which defect is the leading character, and those which show altered relationship of parts. The word *apparent* is inserted, because that which is commonly called a "double" uterus is really an organ the two component parts of which, derived from the two Müllerian ducts, have not fused into one. It will be well to study together the pathology and symptomatology of each variety, for several of them are of considerable interest and importance from the gynæcological standpoint.

Uterus accessorius and Trifid Uterus. — *Pathology.* — The uterus accessorius and the trifid uterus are probably the rarest anomalies of that organ which have been recorded. In 1894 Holländer, during the performance of laparotomy, found a second uterus lying in front of the normal one, between it and the bladder. This he termed a "uterus accessorius." The normal organ was supplied with normal tubes and ovaries, had the round ligaments attached to it, and was retroflexed. The accessory uterus had neither annexa nor round ligaments, was anteverted, and contained some placental tissue. There was a single cervix with two orifices separated by a bridge of tissue. Each orifice communicated with the interior of one uterus. In a similar case, observed clinically by Skene, there was a small second uterus lying in front of the normal one.

Depage, also during a laparotomy, found a still more complicated and puzzling uterine anomaly, which he termed "trifid uterus." There was a bifid uterus with a single cervix and two internal cervical orifices; but there was also found, attached to the cervix, a third uterine lobe forming a closed sac containing altered blood. Blood cysts were found in the ovaries.

It is difficult to offer a satisfactory explanation of the mode of origin of these two malformations. It might be thought that in the case of the uterus accessorius we had to do with a uterus didelphys in which rotation had brought the two horns into an antero-posterior relation; but this supposition utterly fails to explain the attachment of the annexa and round ligaments to one uterus. The most feasible explanation of both the accessory and the trifid uterus is that during embryonic life a diverticulum is formed from one of the Müllerian ducts, and that this develops into the supplementary organ. If this be so, these anomalies fully deserve to be called malformations "by excess," which the so-called "double" uterus does not.

Clinical features.—Holländer's patient had had seven labours, and had thrice aborted, once with twins, at the fourth month. The placental tissue was found in the uterus accessorius, that is, in the organ without annexa. Skene's patient suffered from leucorrhœa from the accessory uterus. The case seen by Depage was in a young unmarried girl; and in this instance, as well as in that of Holländer, an entirely erroneous diagnosis was made, and the true state of affairs was discovered during laparotomy.

Uterus didelphys.—*Pathology.*—The uterus didelphys—or, as it has also been named, "diductus," "duplex," or "separatus"—exhibits the maximum degree of separation of the two laterally placed halves which normally fuse into the single uterus (Fig. 47). There appear to be two single uteri lying side by side, each, however, possessing only one ovary, tube, and round ligament. There may, also, be complete or incomplete duplication of the vagina (*septa* or *subsepta*); or that canal may be single (*simplex*). The two wombs are seldom exactly equal in size, and one of them may be imperforate, a condition giving rise to hæmatometra at puberty. Both uteri may be retroverted (Ameiss), or both may be fœtal in their development (Bernhard). Not uncommonly this uterine malformation is associated with deformities of neighbouring parts, such as ectopia vesicæ and atresia ani. Among the causes which have been invoked to explain the want of union of the two Müllerian ducts, and the consequent formation of the uterus didelphys, are distension of the allantois, non-closure of the anterior abdominal wall, and the existence of adhesions between the rectum and bladder.

Clinical features.—Since it is impossible clinically to separate cases of uterus didelphys from those of uterus bicornis, it will be convenient to consider the symptomatology of the two malformations together.

Uterus bicornis.—*Pathology.*—A much commoner malformation is the uterus bicornis, in which the two halves or horns are not entirely separate, as in the didelphous organ, but are united more or less intimately at their lower ends; that is, in the region of the cervix or lower part of the corpus uteri (Fig. 48). The middle portions of Müller's ducts have evidently begun to fuse together, but coalescence has stopped short of the normal, and an organ is produced exhibiting clear indications externally of its two-horned origin. The bicornute uterus is the connecting link between the *uterus didelphys*, in which the external appearances show two quite ununited halves, and the *uterus septus* or *bilocularis*, in which outwardly the organ gives no indication of duplication. The uterus bicornis also shows all the possible grades between the variety in which there are two horns united only in the cervical region, and that in which the double

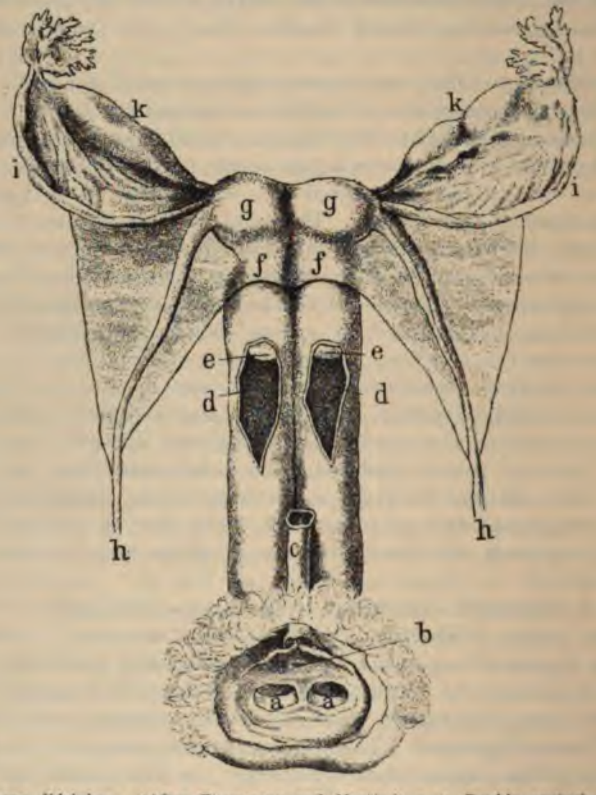

FIG. 47.—Uterus didelphys. (After Eisenmann and Martin.) *a*, *a*, Double vaginal entrance; *b*, urethral opening; *c*, urethra; *d*, *d*, double vagina; *e*, *e*, double cervical orifice; *f*, *f*, double cervix; *g*, *g*, double uterine body; *h*, *h*, round ligaments; *i*, *i*, Fallopian tubes; *k*, *k*, ovaries.

character of the organ is indicated merely by a depression or notch at the fundus (*uterus introrsum arcuatus* or *uterus cordiformis*). The two horns may be practically equal in size; but, on the other hand, one may be much less developed than the other, and in this way there is an approximation to the type of the uterus unicornis. All the intermediate varieties have been observed. The degree of separation of the horns varies greatly. In the most marked cases they are far apart superiorly, and between them is frequently found a band or frenum (recto-vesical ligament), passing from the bladder to the rectum. In less evident cases the horns lie close together, but are not united; and in yet other instances a shallow depression at the fundus shows that fusion of the two Müllerian ducts has closely approached the degree found in the normal uterus. When the horns are markedly separate the left one is usually directed slightly forwards, showing that some degree of uterine torsion has occurred. In other cases they may lie exactly side by side.

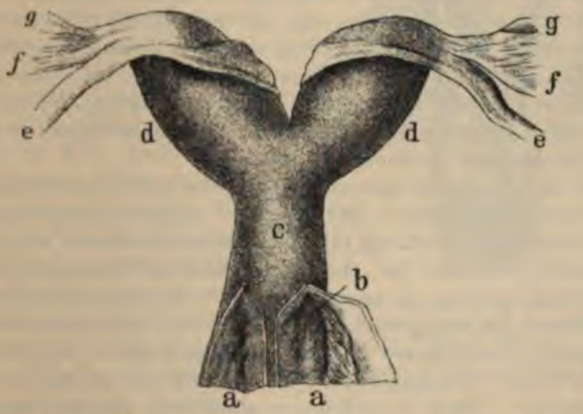

FIG. 48.—Uterus bicornis. (After Schröder and Martin.) *a*, *a*, The vaginæ, laid open; *b*, the left cervix; *c*, the cervix, externally apparently single, but divided into two internally; *d*, *d*, the two uterine horns; *e*, *e*, the round ligaments; *f*, *f*, the Fallopian tubes; *g*, *g*, the ovaries.

The cervix uteri may be broad and large, and may show a double orifice (*uterus bicornis duplex*, *septus*, or *bicameratus*); it may be large, but with only one os; or it may be of normal size and provided with a single orifice (*uterus bicornis unicollis*). The vagina may be septate, subseptate, or single; and the external genitals are usually normal. Sometimes there are anomalies of neighbouring or more distant organs, for example *ectopia vesicæ* and *polydactyly*; and such monstrosities as *cyclopia* and *anencephaly* have been noted in non-viable infants with this type of uterine anomaly.

With regard to the internal appearances of the uterus bicornis it is common to find a septum dividing that part of the organ which appears single externally into two compartments internally. In other cases one or both horns may be solid, semi-solid, or imperforate at one or more places.

In such instances an accumulation of blood may occur at puberty behind the imperforation. The cervix may show a double or a single canal.

Clinical features.—Apart from the reproductive functions the uterus bicornis has little clinical importance; but it has recently been noted that chlorotic girls are not infrequently the subjects of this type of anomaly, and probably chlorosis is to be regarded as a developmental morbid state. It has been affirmed also that in early life difficulty may arise in the evacuation of the bladder and bowel from the concomitant malformations.

The menstrual functions may be variously affected by the presence of a didelphous or bicornute uterus. Menstruation may occur every fortnight, every month, or once in two months. In the first case the discharge comes from both uterine cavities each month, but there is no coincidence of dates, and therefore it has a fourteen day interval. In the second case there is either a simultaneous discharge from both wombs, or else the menstrual flow is from one cavity the one month and from the other the next. And in the third instance, as is shown in a case reported by T. A. Emmet, there is a bimonthly flow from one-half, whilst on the other side there is an imperforate condition of the horn, vagina, or hymen, which prevents the appearance of a discharge. Dysmenorrhœa is met with often and amenorrhœa occasionally.

Sterility is sometimes associated with the bicornute uterus, but, on the other hand, the patient is often fertile. Pregnancy may occur in one horn, and a menstrual discharge take place from the other—a circumstance which possibly accounts for the continuance of menstruation during gestation which has been occasionally noted. Decidual membranes may, however, form in the empty horn. Pregnancy may also occur in both horns simultaneously, or at different but not far distant dates; and in the latter case may be found the explanation of some of the anomalous instances of superfœtation. There is evidence to show that gestation may happen in each horn alternately. In rare cases a twin conception has taken place in one horn.

The bicornute uterus may abort; or labour may occur at the full term, when the empty horn may show contractions as well as the gravid one, and its os also may open. Parturition may be normal; there may be a malpresentation; the recto-vesical band may cause delay in the passage of the fœtal head, or there may be low implantation of the placenta and hæmorrhage. When, as sometimes happens, the pregnant horn is shut off by a septum, gestation becomes practically extra-uterine, and has all the dangers associated therewith, such as uterine rupture. Even in cases in which there is not unilateral atresia, rupture of the uterus, or of the septum between its horns, may occur. Halban, for instance, has shown that where the pregnant horn lies obliquely to the empty one, the head of the infant may be driven during labour through the septum between the two cavities; thus, what was a left-sided fœtus may be expelled through the right cervical orifice.

The diagnosis of the presence of a bicornute uterus is often not made till pregnancy and labour have taken place; and sometimes not even then. When menstruation occurs every fortnight, or persists during pregnancy, the anomaly may be suspected. The presence of a double vagina, cervix, or os uteri suggests the existence of a double uterine cavity; and a thorough bimanual examination, conjoined with the careful use of the sound—if there be no evidence of pregnancy, ought to clear up the case. The instances in which one horn is imperforate are rarely diagnosed.

Uterus septus.—*Pathology.*—The uterus septus, or, as it is also called, bilocularis or globularis, gives no indication by its external appearance that internally it is divided, more or less completely, into two cavities by an antero-posterior vertical septum or partition (Fig. 49). The cases in which the septum is imperfect have, however, also been grouped together under the name *uterus subseptus*, or *semipartitus*; and, according to the extent of the partition, certain sub-varieties have been distinguished. Thus, when it is found in both body and cervix, leaving, however, the os externum uteri single, we have the *uterus subseptus uniforis.* When it exists in the body, but does not extend beyond the os internum, there is produced the *uterus subseptus unicollis.* When it is present only in part of the body it constitutes the *uterus subseptus unicorporeus*; and when it is found only near the os externum it is the *uterus biforis supra simplex.* From this enumeration of its varieties the pathological characters of the uterus septus will be evident. It may be added that the best-marked type has a normal fundus, two uterine cavities situated laterally, and existing both in body and cervix; and not infrequently there is also a partially or completely septate vagina. The uterus septus shows, therefore, a more advanced degree of fusion of the Müllerian ducts than does the uterus bicornis; but still the fusion is incomplete, as is shown by the more or less perfect septum which remains.

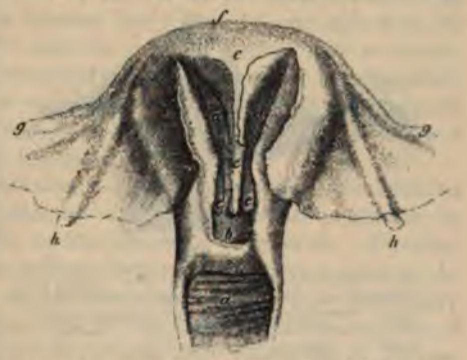

FIG. 49.—Uterus septus. (After Gravel and Martin.) *a*, Vagina; *b*, single, lower part of cervix; *c*, *c*, septum, thicker above, thinner below; *d*, *d*, right and left uterine cavities; *e*, *e*, two projections near the os uteri internum; *f*, fundus uteri; *g*, *g*, Fallopian tubes; *h*, *h*, round ligaments.

Clinical features.—What has been written regarding the clinical manifestations associated with the uterus bicornis may be applied also to the uterus septus. Further, an incomplete septum may be the cause of a malpresentation—for instance, a transverse case, or of a low insertion of the placenta. The after-birth may even be attached to the septum itself—an arrangement certain to give rise to dangerous hæmorrhage after the birth of the infant. It would seem that abortion is common in this uterine anomaly; at any rate Ruge, by dividing the septum in the case of a patient who had twice miscarried, was rewarded by finding that her next pregnancy went to the full term. During curettage the curette has been known to pass from one cavity of a septate uterus into the other, giving the sensation of perforation of the organ (Blondel). The diagnosis of the uterus septus is only likely to be made during labour, when the hand, introduced into the uterus to perform version or to extract the placenta, may detect the presence of the partition. As with the uterus bicornis, one cavity may not communicate with the vagina, and thus hæmatometra with its train of symptoms may arise.

Uterus unicornis.—*Pathology.*—The uterus unicornis is an organ in which one horn alone is well developed (Fig. 50). There are two varieties: that in which the second horn is altogether absent (*uterus unicornis sine ullo rudimento cornu alterius*), and that in which there is a solid or hollow rudiment of it (*uterus unicornis cum rudimento cornu alterius solido seu excavato*). In the former case there is complete, in the latter partial defect of one of the Müllerian ducts. The uterus unicornis has really no fundus, the single horn inclining to one side of the middle line and tapering to a point at which it is continuous with the Fallopian tube, and where the round ligament is attached. The ovary thus comes to lie at the apex of the bent cone formed by the single horn and the corresponding tube. The cervix uteri is usually small and the vagina narrow, absent, or septate. The single horn may also be imperfectly developed, and may be solid or partly excavated. Certain concomitant malformations have been noted: thus, the Fallopian tube, round ligament, and broad ligament are commonly absent on the side of the missing horn; the corresponding ureter and kidney may also be wanting, and the bladder may be developed on one side only. The ovaries may be present, but are often rudimentary.

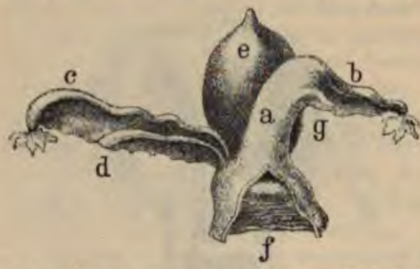

FIG. 50.—Uterus unicornis, posterior view. (After Pole and Martin.) *a*, Right half of uterus—the left horn has not been developed; *b*, right Fallopian tube; *c*, left Fallopian tube; *d*, left ovary; *e*, bladder; *f*, vagina; *g*, right ovarian ligament.

In some cases, as has been stated above, a rudiment of the second horn may be present; it may be solid or hollow, and in the latter case its cavity may or may not communicate with that in the first horn. Such cases form the connecting links between the typical uterus unicornis and the bicornute organ. This rudimentary horn may be the seat of a pregnancy, or a collection of menstrual blood may be found in it. A fibroid tumour may be found attached either to it or to the other better-formed horn, as in a case noted by Mangiagalli.

Clinical features.—A patient with a uterus unicornis commonly gives a history of amenorrhœa; but sometimes menstruation goes on normally, and pregnancy occurs in the single horn. When a rudimentary horn is present, and when it becomes the seat of a gestation, a very serious state of affairs is established; in fact, the case becomes practically one of extra-uterine pregnancy, and is accompanied by the same dangers, that is, rupture and intra-abdominal hæmorrhage. When in such a case the rudimentary pregnant horn has no communication with the uterus unicornis it seems necessary to admit extra-uterine migration either of the ovum or of the semen.

The presence of a uterus unicornis, with or without a rudimentary horn, commonly passes unnoticed during life, unless it be discovered during the performance of laparotomy. If the condition be suspected, a careful bimanual examination, aided by the use of the sound, will reveal the presence of a thin, elongated uterine body bent to one side with its concavity outwards. There will also be a small cervix and a narrow vagina. Pregnancy in the rudimentary horn cannot be distinguished from an ectopic gestation of the tubal variety, unless rupture occur and the abdomen be opened. In a case seen by myself it was mistaken for a fibroid tumour, a mistake which laparotomy revealed.

Uterus rudimentarius.—*Pathology.*—The name uterus rudimentarius is a vague one. From one point of view it may with propriety be applied to such anomalies as the uterus unicornis or bicornis. Further, the distinction between it and complete absence of the organ can only be made after a careful autopsy. At the same time, it has been customary to restrict the application of the term to the cases in which, in place of the normal organ, one finds a body of variable form consisting of fibrous, muscular, or fibro-muscular tissue, sometimes solid and at other times showing a rudimentary cavity (*uterus rudimentarius solidus, uterus rudimentarius partim excavatus*). Through its partly excavated variety it is closely related to atresia of the single uterus. In one form of the rudimentary uterus the walls are so thin that it has been called *membraniform*, or the *uterus membranaceus*. More commonly, however, a small solid mass of muscular tissue is found in the middle line between the folds of the broad ligaments, which seem in such a case to sweep in an almost unbroken band from one side of the pelvis to the other. The tubes, ovaries, cervix, and vagina are usually absent or very imperfect; but cases have been reported in which the annexa were normal. The external genitals are, as a rule, well formed. The mammæ are usually small, and there is often a poor growth of hair on the mons veneris.

Clinical features.—Since the rudimentary uterus cannot be clinically distinguished from absence of the organ, the symptomatology of the two conditions will be considered together. The recent literature of both anomalies will be given at the same time.

Uterus deficiens seu Defectus uteri.—*Pathology.*—Complete absence of the uterus, its annexa, and (to some extent also) the external genitals, is met with commonly enough in the acardiac twin and the sympodial fœtus; but its occurrence in the adult and otherwise normal individual is very rare. It is necessary to make a complete post-mortem examination before it can be definitely said that no uterus exists; and in most of the reported cases such evidence is not forthcoming. Further, in certain instances the individual was evidently a male with undescended testicles, not a female without a uterus.

When the Fallopian tubes as well as the uterus are absent the peritoneum passes directly from the bladder to the rectum; but when they are present it forms a mesentery for each, although even then broad ligaments in the strict sense of the term can scarcely be said to exist. The round ligaments are generally to be found; they end in the cellular tissue between the rectum and bladder. The ovaries may be absent, but generally they are present, and then they commonly contain no ovisacs; very rarely they are normal. The tubes when present are simply solid rods of tissue, with usually an open ostium abdominale. The vagina is often wanting entirely; but sometimes there is a shallow *cul-de-sac* (vestibular canal) communicating with a vulva which is usually normal. There may, however, be an absence of the vulvar hair. In rare cases the vagina has been found well developed. The pelvis has a feminine breadth; but the mammæ are often poorly developed.

Clinical features.—A woman without a uterus, or with merely a rudimentary one, may have all the secondary characters of her sex; she may have a high-pitched voice, rounded outlines, and an absence of hair on the face. Sexual desire may or may not be present—a circumstance which is probably determined by the state of the ovaries. Amenorrhœa is practically constant; as, however, ovulation may occur, menstrual molimina may be met with, and there may be vicarious hæmorrhages or such acute pelvic pain as to necessitate an operation for the removal of the ovaries (Vineberg). There is, of course, sterility always; but the patient may be capable of coitus to a certain extent. Usually, however, cohabitation is attended by great pain. Repeated attempts on the part of the husband deepen the shallow vestibular canal, converting it into a *cul-de-sac* of some depth; in other cases dilatation of the urethra is brought about.

Although it is impossible clinically to distinguish between absence and a rudimentary state of the uterus, it is always possible to ascertain the existence of one or other of these anomalies. By passing the index finger into the rectum and a sound into the bladder, whilst the abdominal wall is deeply depressed from above, one can determine that there is nothing like a fully-formed uterus between the rectum and the bladder. A transverse band consisting of the tubes may be palpated, as may also the ovaries when they are present. These physical characters, taken in conjunction with the symptoms, enable the gynæcologist to make a diagnosis sufficiently exact to prevent his continuing a hopeless course of treatment by ferruginous tonics and the like for the establishment of menstruation.

Uterus fœtalis.—*Pathology.*—The anatomical characters, which are normal in the uterus during intra-uterine life, may persist and be found in the adult. They then constitute an anomaly—uterus fœtalis. The cervix uteri is longer than the body, and its walls are thick, whilst those of the body are thin. The cervix also is conical and os externum narrow. The whole organ is cylindrical in form, and is small in size, the sound passing in for a distance of only an inch or an inch and a half. The term *infantile uterus* may be used as a synonym for fœtal uterus; but a shade of difference has been recognised by some writers. In the uterus fœtalis the folds of the mucous membrane are found in the body of the organ, whilst in the infantile organ they exist only in the cervix. The mucous membrane also is poorly developed, and, according to de Sinéty, contains no tubular glands. The vagina may be short and narrow, or it may be quite normal. The external genitals may be imperfect, and the ovaries and tubes may either be normal or rudimentary. Mammary development is usually little marked. It may be added that the uterus fœtalis may be also a uterus bicornis.

Clinical features. — With the uterus fœtalis there is commonly amenorrhœa; sometimes, however, there is scanty and painful menstruation. Sterility is a constant symptom, and there may or may not be sexual appetite. Chlorosis has frequently been found associated with a fœtal or infantile uterus. The heart may be small, and there may be a general hypoplasia of the whole vascular system. The uterine anomaly may be diagnosed by means of bimanual examination, aided by rectal touch and the use of the sound. The differential diagnosis between the uterus fœtalis and the uterus pubescens is chiefly founded upon the state of the cervix: in the former it is fairly firm, especially in the supravaginal portion; in the latter it is thin and relaxed. The condition, however, may be complicated, and to some extent masked, by concomitant perimetritis and metritis. Attempts at treatment of the anomaly have almost invariably ended in failure; and practically the only thing to be done is to relieve the dysmenorrhœa, if it be present, by the use of drugs; or possibly, if severe, by oophorectomy.

Uterus pubescens. — *Pathology.* —The pubescent uterus occupies an intermediate position between the uterus fœtalis and the normal virginal organ. It shows a persistence of the anatomical characters which are normal before the epoch of puberty. The organ is small in size, weighs less than normal, and has a cervix and a body of practically equal length. The ovaries, tubes, vagina, and mammæ may or may not share in this condition of hypotrophy.

Clinical features.—The symptoms of pubescent uterus closely resemble those associated with the fœtal or infantile organ. Menstruation may be absent, or scanty and irregular. Sterility is common, but there is always the hope that the organ may yet undergo further development and the patient become pregnant. Signs of general weakness, chlorosis, or rickets may coexist; but the anomaly may also be met with in strong and healthy women. The diagnosis is made by the same means as in cases of fœtal uterus, especial attention being paid to the condition of the cervix and its size compared with that of the body of the organ. If the condition be discovered before marriage, the treatment to be adopted is a general tonic one, consisting in the use of gymnastic exercises, of nourishing food, and of iron, quinine, and arsenic. After marriage the periodical passing of the sound, the insertion of an intra-uterine stem-pessary, and electricity may all be employed with some hope of success. The effect of marriage itself may be beneficial; emmenagogues are of doubtful efficacy. Marriage ought not to be recommended unless menstruation has become established.

Uterine Atresia and Stenosis.—*Pathology.*—The uterus may be congenitally imperforate—an anomaly which finds its explanation in the originally solid condition of the ducts of Müller from which it is developed. Uterine atresia is not so much an independent malformation as a complication of other anomalies of the organ, for instance of its bicornute and unicornute condition. Nevertheless it occurs also in cases of single and otherwise normal uteri. The whole cervix may be solid, or there may simply be a septum at the os externum or os internum uteri. At the age of puberty menstrual blood begins to accumulate behind the obstruction, leading in time to the distension of the uterus (hæmatometra). When one horn of a bicornute uterus is imperforate, unilateral hæmatometra is produced; when both horns are occluded there is bilateral hæmatometra. When the obstruction is situated at the os internum only the body of the uterus becomes distended, the cervical canal retaining its natural form. An accumulation of blood may be found in the tubes also (hæmatosalpinx), and it would appear that the source of the blood is the tubal mucosa, and that it is not due to regurgitation from the uterine cavity. When there is simple narrowing of the cervical canal without atresia the condition known as uterine stenosis is produced.

Clinical features.—Since the symptoms of uterine atresia are mainly those of hæmatometra, and since these are found also in association with atresia vaginæ, their consideration will be deferred till that vaginal anomaly has been described. In the cases of uterine stenosis, dysmenorrhœa is the leading symptom, and dilatation of the cervical canal is needed for its cure. Uterine atresia for its relief requires puncture and subsequent dilatation of the obstruction. This should be done with strict antiseptic precautions; and, when the accumulated fluid has escaped, the cavity should be packed with iodoform gauze for some days, and douched occasionally with weak antiseptic solutions.

Transverse Septum in the Cervix uteri.—*Pathology.*—A condition somewhat similar to atresia uteri is the presence of a valvular fold or diaphragm in the cervical canal. When the os externum has been dilated the valve may present the appearance of a second cervix within the first. It is possibly produced in the same manner as the more common transverse septa of the vaginal canal.

Clinical features.—The septum would seem to act like a polypus, and gives rise to hæmorrhage and pain. It has been excised with complete relief of symptoms. It may also be the cause of dystocia; but this is not a constant effect.

MINOR MALFORMATIONS OF THE UTERUS.—Müller of Berne has pointed out the frequency of certain minor abnormalities of the uterine fundus. Amongst these is the anvil-shaped uterus (*uterus incudiformis* or *biangularis*), in which the normal convexity of the fundus is wanting, and a straight line joins the two Fallopian tubes. It closely resembles the uterus with a flat fundus (*uterus planifundalis*) of Fürst's classification, and may coexist with partial or complete duplication of the uterus and vagina.

The vaginal cervix may be rudimentary or absent (*uterus parvicollis* or *acollis*), whilst the body of the organ may be normal, small, atresic, or membraniform. A case of this kind has been reported by Penrose. Again, a frenum may be found dividing the os externum into two orifices (*uterus biforis*), a condition which is normal in the ant-eater (Pozzi). This exists without any other trace of duplication of the genital canal. It may complicate labour, during which it may be torn and give rise to hæmorrhage. In order to prevent this it ought to be kept to one side or divided between two ligatures.

A condition which may easily be mistaken for the uterus unicornis is that in which there is asymmetry of the organ, one side being better developed than the other. The uterus bends towards the better-developed side (latero-version or obliquity of the uterus), and the round ligament on that side is relatively short. Latero-position of the uterus is met with when one of the broad ligaments is less developed congenitally, and is to be distinguished from the acquired condition due to unilateral inflammation and cicatricial contraction.

Congenital Prolapsus uteri.—*Pathology.*—What has been called congenital prolapsus uteri is an exceedingly rare anomaly. John Thomson and I reported two cases of it in 1897, and we gathered together some other instances from medical literature; since then, cases have been recorded by Hansson, Radwansky, Andrews, and Doléris. At first it seemed as if it always occurred in association with lumbo-sacral spina bifida; but instances have been recently reported in which the spina bifida was absent (Andrews, Radwansky). It is a true prolapse of the uterus.

Abnormal Communications of the Uterus.—The uterus may in rare cases communicate with the rectum or bladder, or with both viscera at once. In an extraordinary instance reported by Mr. Doran the right side of a bipartite uterus opened on the outer surface of the body. There may also be a communication between the uterine cavity and that of the ascending colon. Most of these anomalies must be ascribed to a partial or complete persistence of the embryonic cloacal condition. When combined with vaginal atresia it would seem that impregnation has occurred per rectum or per urethram.

MALFORMATIONS OF THE VAGINA.—If, as Dr. Berry Hart maintains, only the upper two-thirds of the vagina are developed from the Müllerian ducts, it is easy to understand how some of the vaginal malformations will differ from those of the uterus. As a matter of fact, the anomalies of the lower end of the vagina are closely associated with those of the neighbouring organs (bladder and rectum): an association which is easily explained if the lower third of the canal be developed from the coalescence of the Wolffian bulbs and the urino-genital sinus.

Double Vagina (Vagina septa).—*Pathology.*—A double vagina in the exact sense of the term can only be said to exist in certain double terata, such as the pygopagous twins; but it has become customary to apply the name to the cases in which the two Müllerian ducts, which normally fuse into one canal, have remained separate, a septum intervening between the two passages in part or in the whole of their extent.

Just as the uterus didelphys is very rare, so two vaginal canals, completely separated and each opening externally at a separate vulva, constitute an anomaly of a very uncommon form. The only reported case of the kind seems to have been that of Katharine Kaufmann, seen by Suppiger in 1876. This child, who died at the age of twenty-one months, had two vulvæ each opening into a vaginal canal. The pelvis was broad, and the true pelvis was divided into two lateral cavities by a peritoneal fold. Each half contained a bladder, a unicornute uterus with an ovary and a tube, and an intestinum rectum. The vertebral column began to divide at the level of the third lumbar vertebra, and the two coccyges were quite separate. This individual has been placed amongst the double terata.

Much more common are the cases of "double" or septate vagina, in which, although the hymen may show two openings, the vulva is single. The two canals are separated by a longitudinal septum; in the great majority of cases this vertical septum runs antero-posteriorly, and the vaginæ, therefore, are situated laterally; in a very few cases only does it pass transversely, when of course the vaginal canals lie one in front of the other. In the latter case it must be supposed that the two unfused Müllerian ducts have undergone partial rotation. It is rare, however, to find the two canals exactly lateral in position and exactly equal in size; one, usually the left, commonly lies a little in front of the other, and one is nearly always a little smaller than the other. The septum is composed of muscular tissue covered by mucous membrane, and has the consistence of the recto-vaginal septum. It varies, however, in thickness, and may even at certain places show perforations. It may extend the whole length of the canals, or it may be absent below and present above (*vagina infra simplex* or *septa supra*), or present below and absent above (*vagina septa infra* or *supra simplex*). In the least marked form there is only a ridge on the vaginal wall. In the great majority of cases the uterus also is double, and may be didelphous, bicornute, or septate, and then there is usually one cervical orifice in each vagina; but in a few recorded cases the uterus was single, although the vagina was double, when of course only one canal gave access to a cervix. Instances have also been reported in which the uterus was unicornute, then one of the vaginæ, that on the same side as the absent horn, was usually rudimentary. This last-named type, however, scarcely deserves to be termed a double vagina. The vulva and the hymen may be single, the vaginal septum stopping above the level of the ostium; but in some cases the hymen shows two lateral orifices separated by a bridge of tissue. There may be atresia of one or both vaginal canals, leading in the adult to unilateral or bilateral hæmatocolpos.

Clinical features. — Double vagina does not usually give rise to symptoms prior to the occurrence of labour, unless one of the canals be imperforate; then at the time of puberty blood may begin to collect behind the obstruction, and give rise to the troubles associated with hæmatocolpos and hæmatometra. It has been stated that during pregnancy the septum may be absorbed; but if it be still present at the time of confinement it may give rise to trouble by obstructing delivery. It may tear, and labour go on naturally; on the other hand, the rupture of it may extend to the vagina and uterus also, and fatal consequences result. In yet other instances the septum is pushed to one side, and no delay in labour occasioned. Dyspareunia has been occasionally reported as an effect of the septate vagina. The diagnosis of the anomaly can be easily made by a vaginal examination, save in the cases in which one canal is imperforate; then the condition might easily be mistaken for a cyst of the vaginal wall. The simple septum may be safely divided by scissors during labour. When, however, there is an accumulation of menstrual blood in one-half of the canal it will be necessary to open the sac freely, more especially if the contents are purulent, and to pack the interior with iodoform gauze.

Unilateral Vagina.—In the rare cases in which only one horn of the uterus is developed (*uterus unicornis*) there is generally a similar condition of the vagina. In other words, the lower end of one of the Müllerian ducts has aborted, and the vaginal canal which exists represents one and not both of the embryonic tubes from which it is normally developed. This being so, it is not surprising to find that the vagina is then narrow, and lies somewhat to one side of the middle line. The anomaly is so constantly associated with the unicornute uterus that any special description of it is rendered superfluous.

Vagina rudimentaria. — Vagina rudimentaria, like the term uterus rudimentarius, is a vague expression. It denotes an anomaly which has also been described as simple atresia and lateral atresia vaginæ; and clinically no line of demarcation can be drawn between it and complete absence of the vagina (defectus vaginæ). It will therefore be discussed under those heads.

Defectus vaginæ.—*Pathology.*—Complete absence of the vagina is a very rare condition—one which is met with chiefly in the allantoido-angiopagous twin fœtus and in the sireniform monstrosity. In it no muscular bands are found between the bladder and rectum, otherwise the condition falls into the category of vaginal atresia or rudimentary vagina. Probably it is always associated with absence of the uterus, Fallopian tubes, and external genitals, and with an imperfect development of the mammary glands.

Clinical features.—Since this is a pathological, not a clinical morbid state, the consideration of its symptoms will be taken with those of vaginal atresia, a condition from which during the life of the individual it is undistinguishable.

Atresia vaginæ.—*Pathology.*—Vaginal atresia or imperforation is of different degrees. In its most marked form no trace of the canal is found save a fibrous or fibro-muscular band in the tissue between the bladder and rectum; in a less extreme form, part of the vagina is present whilst the remainder is solidly imperforate; and in a still less marked form, there is simply a membranous obstruction or perforated diaphragm at one part of the passage. Again, the position of the imperforation varies; it may exist throughout the whole length of the canal, or it may be present only at the upper part, the lower part, or the middle part. Atresia of the lower part of the vagina may be due to imperfect coalescence of the Wolffian bulbs with the urino-genital sinus. With regard to the condition of the other genital organs in cases of vaginal atresia great differences exist. The uterus may be normal, rudimentary, or absent. The vulva also may be wanting or imperfect; but more usually it is normal, and the hymen is present. The ovaries are commonly present. The urethral canal may be dilated, the result of attempts at coitus. Certain pathological changes commonly occur at puberty; if the uterus be present and the whole vagina imperforate, hæmatometra is developed and the uterus converted into a large rounded sac containing blood, first the cervix and later the body becoming distended; if the upper part of the vagina be patent, then blood first accumulates in it, and hæmatocolpos is produced, hæmatometra being a later development; if the vaginal obstruction affect only the lowest part of the canal, hæmatocolpos may be the sole result, the uterus remaining as a small body surmounting the distended vaginal tumour. Hypertrophy of the vaginal walls may be produced, or from the accumulation of blood rupture may occur into one or other of the neighbouring viscera. In certain instances the Fallopian tubes also become distended, and hæmatosalpinx results. The contents of the distended vagina, uterus, or tube are usually treacly in character, consisting as they do of concentrated blood. After rupture or artificial evacuation suppuration may supervene in the sac, and pyocolpos, pyometra, and pyosalpinx be produced.

Clinical features.—The symptoms associated with vaginal atresia are chiefly those due to the accumulation of blood in some part of the genital canal at and after the period of puberty. In early life, it is true, some discomfort may be caused by the retention of mucus in the patent part of the canal, leading to constipation and dysuria by pressure; but the special clinical features are all developed after puberty. There is, of course, amenorrhœa; then gradually, unless indeed the uterus be absent, a swelling is developed in the lower abdominal region in which fluctuation can often be detected. There is sometimes a bulging in the region of the vulva and perineum. These signs are caused by the gradual accumulation of menstrual blood behind the obstruction. Severe pelvic pain is experienced, recurring with increasing severity at intervals of a month;

this is sometimes accompanied by vicarious menstrual hæmorrhages from other parts of the body; for example, hæmoptysis, or hæmatemesis. If the patient marry, cohabitation is found to be very difficult and painful, if not impossible. In time, however, the vestibular canal or urethra becomes distended, and an imperfect degree of coitus is rendered possible; then the urethral dilatation leads to dysuria. There is of necessity sterility. In a case reported by Grandin the anomaly existed in several members of the same family.

The diagnosis of the anomaly ought not to be a matter of difficulty. When, in a patient with amenorrhœa and monthly pelvic pain of increasing severity, an abdominal tumour, which fluctuates and gradually enlarges, is discovered, the presence of vaginal atresia may be suspected; and when, in addition, it is found on examination that the vagina is blocked either near its orifice or at its upper part, the diagnosis may be safely made. Further examination by means of rectal touch, aided by the presence of a sound in the bladder, abdominal palpation, and vaginal touch (when the lower part of the vagina is patent), is chiefly undertaken with a view to finding out the extent of the atresia and the condition of the uterus and ovaries, so that proper treatment may be adopted. In carrying out this investigation it will be well to give the patient chloroform. The line of treatment will be largely decided by the extent and position of the atresia, by the state of the internal genital organs, by the presence or absence of retained blood, and by the circumstances of the patient. In the cases in which there is well-marked vaginal atresia with absence of the uterus, but with the presence of functionally active ovaries, as shown by recurring severe pelvic pain, the operation of oophorectomy has been recommended and successfully carried out in several instances. When, on the other hand, a more or less normal uterus is associated with hæmatocolpos, entirely different operative interference is indicated. It is not wise to leave the blood-accumulation to nature; for rupture of the sac, even when it occurs through the vagina, is seldom safe in its immediate, or satisfactory in its ultimate results. An incision ought to be made into the sac and the contents evacuated under strict antiseptic precautions. If the atresia be slight, and situated low down in the canal, the evacuation may be easily and safely carried out; but if a large part of the vagina be atresic, difficulties and dangers are met with. Dissection must be carefully performed with a sound in the bladder and a finger in the rectum as guides; and the handle of the knife should be freely used, in order to avoid wounding neighbouring organs. When the dissection has nearly reached the blood-sac, as determined by rectal touch, a trocar should be introduced to evacuate the fluid; then the cavity should be laid freely open, washed out with antiseptic lotion, and plugged with iodoform gauze. If it be found that the accumulation of blood is in the interior of the uterus, then the same method of procedure must be followed, with even closer attention to antisepsis. Puncture through the bladder or rectum is not an operation to be recommended.

When in a married woman there is vaginal atresia, but no hæmatocolpos or hæmatometra, operative interference need not be urged unless the patient herself anxiously desires it. Then the question of the advisability of trying to create an artificial vagina will arise. It has been suggested that the urethra should be dilated to allow of coitus; but the proposal has not been received with favour, and it would have been surprising if it had. The creation of an artificial vagina between the bladder and rectum is a difficult operation, requiring a great deal of careful dissection; and it is followed in many cases by disappointing results. If it be attempted, an H-shaped incision should be made in the vulvar region, and then, by means of the finger rather than the knife, a cavity of sufficient depth should be formed; this cavity must next be lined by mucous membrane and skin taken from neighbouring parts and sutured into position; it must then be stuffed with iodoform gauze, and kept open afterwards by a wooden cone-shaped pessary. At a later period the canal is kept open by coitus. Possibly in the future it may be found to be better to dissect upwards and open into the peritoneal cavity at once, as P. Walton recommends; in this way the operator gets a finger into the pouch of Douglas, and can identify the structures more easily and determine the state of the ovaries and tubes; the peritoneal opening can then be closed with sutures, and the construction of the vagina proceeded with. Of course it must be borne in mind that, as the uterus is either absent or rudimentary, which is demonstrated by the absence of a blood accumulation, the operation is undertaken solely to allow the patient to perform her part in the act of coitus. This being the case, it is no matter for wonder that certain gynæcologists have not favoured any operative interference in such cases.

Atresia vaginæ lateralis.—*Pathology.*—It has been already noted, under the head of Septate Vagina, that one of the canals may be imperforate at its vulvar end, whilst one of the uterine orifices opens into it above. In this way a lateral vaginal pouch or sac is formed, *atresia vaginæ lateralis.* Menstrual blood may collect in the sac and distend it, giving rise to the condition known as lateral hæmatocolpos; suppuration may also occur in it—lateral pyocolpos. The half uterus with which it communicates may likewise be distended with blood or pus (*lateral hæmatometra* or *pyometra*). This vaginal anomaly is nearly always situated on the right side (Puech).

Clinical features.—As in other vaginal anomalies, symptoms do not arise till after puberty, when the gradual dilatation of the lateral vaginal sac gives rise to dysmenorrhœa, pain in the back, dysuria, and pain on defæcation. Vaginal examination reveals an elastic tumour on one side, which may be confounded with pelvic hæmatocele; but it may usually be distinguished by its position and gradual increase in size. Rupture either of the vaginal or uterine septum may occur spontaneously; and dark syrupy blood or pus be discharged. This is usually followed by re-accumulation in the sac, by an increase in the severity of the symptoms, and possibly by the supervention of pelvic peritonitis and even of death.

The *treatment*, therefore, ought to be free incision, washing out of the sac with an antiseptic solution, and in many cases excision of the sac wall.

Winckel has pointed out that inversions or prolongations of the vaginal mucous membrane may be met with, which may extend into the muscular layers of the wall and even into the paravaginal cellular tissue. These pockets have thin, smooth walls, may be from 1 to $1\frac{1}{2}$ inch in length, and must not be confounded with lateral vaginal atresia.

Stenosis vaginæ.—*Pathology.*—The vaginal canal may be abnormally or unusually narrow. The association of this anomaly with the uterus unicornis, and with atresia vaginæ lateralis, has been referred to; but it may also occur in connection with the uterus fœtalis, or even with a normal organ. The stenosis may affect the whole vaginal canal, or may be present at certain points only. The narrowing may be circular, diagonal, or in spiral ridges. The so-called supplementary hymen is probably of this nature. The condition is closely allied to if not identical with transverse complete or perforated diaphragms in the vagina.

Clinical features.—If the stenosis be slight it may give rise to no inconvenience; for coitus, or labour if coitus fail, usually serves to dilate the canal completely. In more severe cases it may be necessary to resort to artificial dilatation, incision, or even excision of the constricting bands. Hæmatocolpos is seldom, if ever, a result of vaginal stenosis when the diaphragm is complete. Rupture of the canal may, however, occur in labour, unless the obstruction is incised.

ABNORMAL COMMUNICATIONS OF THE VAGINA.—The vagina may open into the rectum through an imperfect development of the recto-vaginal septum, which normally intervenes between the two canals. Further, the canal may communicate by a small orifice with the urethra. Most of the cases of abnormal communication of the vagina with the rectum, urethra, and bladder are not really vaginal, but vulvar anomalies; being true instances of persistence of the cloaca of embryonic life, or of the sinus urogenitalis. They will be described amongst the malformations of the vulva. Very rarely, however, cases of congenital ano-vaginal and vagino-urethral fistula have been described. In these instances the anus and rectum, and the urethra are normally formed, and the Müllerian vagina is present at the level of the fistulous communications. In these cases the vagina may be septate. Caradec reported an example of this anomaly in which there was a communication between the rectum and vagina, the anus and rectum being normal; and Fordyce described a new-born infant with fœtal peritonitis, in which each of the two halves of a double vagina opened by a small aperture into the urethra. In the latter case both vaginal canals were atresic inferiorly.

MALFORMATIONS OF THE VULVA.—In considering the malformations of the ovaries, tubes, uterus, and vagina, it has been found most convenient to discuss first the anomalies of these organs separately, and then to refer to those combinations of the anomalies which are most commonly met with. Thus unilateral absence of the Fallopian tube was first described separately, and it was pointed out later that it was usually associated with a uterus unicornis and a unilateral vagina. In dealing with the malformations of the vulva, however, this plan is not so useful, for now we have to do rather with groups of anomalies than with single ones. Thus, whilst something must be said regarding abnormalities of the clitoris, labia, and hymen, our main attention will be turned to such associations of defects as are found in the cloacal conditions, and in the cases of so-called hermaphroditism.

Double Vulva.—The anomaly to which the name double vulva may be correctly applied is a very rare one. In the case of Katharine Kaufmann, already referred to under the head of "double vagina" (p. 150), there were two well-marked vulvæ separated by a raphé. There were on each side two labia majora and minora, a clitoris, hymen, urethra and anus. More recently Chiarleoni has reported a less well-marked case in a living infant, thirty-three months old. In this child there were also two vulvar apertures, of which the left lay somewhat obliquely; but the anus was imperforate, and the condition of the internal organs was not ascertained. The cases of Blanche Dumas and of Mrs. B. (reported by Wells) might be cited as examples of double vulva; but in them there were supernumerary lower limbs.

Defectus vulvæ.—Complete absence of the vulva (*defectus* or *atresia vulvæ*) is an anomaly met with only in non-viable fœtuses, chiefly of the acephalic and sympodial types. The skin passes without any irregularity or solution of continuity from the symphysis pubis to the coccyx. In such a case the anus is absent; but this is not constant, for in some instances an anal orifice has been found. Internally the rectum, bladder, and genital ducts may all open into one cavity—*persistence of the cloaca*; in other cases the recto-vaginal septum has developed, but the bladder and genital ducts have a common termination—*persistence of the sinus urogenitalis*. During fœtal life an accumulation of urine in the bladder and genital canals takes place, and the infant shows at the time of birth considerable abdominal distension from this cause. Cases of so-called absence of the vulva in the adult woman are probably instances of the anomaly next to be described, *atresia vulvæ superficialis*. Defectus vulvæ in the strict sense of the term has no clinical importance.

Atresia vulvæ superficialis.—*Pathology.*—The term superficial vulvar atresia may be applied to those cases in which, on account of adhesion of the labia majora or minora, there is an apparent absence of the vulvar cleft (Fig. 51). Usually the occlusion is not complete, for a small orifice is commonly found near the root of the clitoris through which the menstrual fluid and urine escape. The anomaly may be present at birth, or may be developed in infancy. In both cases it is doubtless due to adhesive vulvitis which leads to adhesion of the labia.

Clinical features.—In early life there may be difficulty in micturition. After puberty the escape of the menstrual flow may be impeded, but hæmatocolpos does not usually result. After marriage the labial adhesion will prevent coitus, but not necessarily impregnation. It is possible on a superficial examination that the condition may be mistaken for atresia vulvæ. It is usually easy to separate the labia by traction; but if this fail, a sound should be passed in through the anterior opening and a careful dissection made down to it. Attempts at coitus may be sufficient to break down the adhesion.

Vulva infantilis.—In the adult the vulva may have preserved its infantile type and characters. This anomaly is usually associated with defective development of the uterus and ovaries, and with such systemic disorders as chlorosis. Its clinical importance is small compared with that of the associated defects; but the existence of an infantile vulva may have some value as an indication of imperfect development of the internal genital organs.

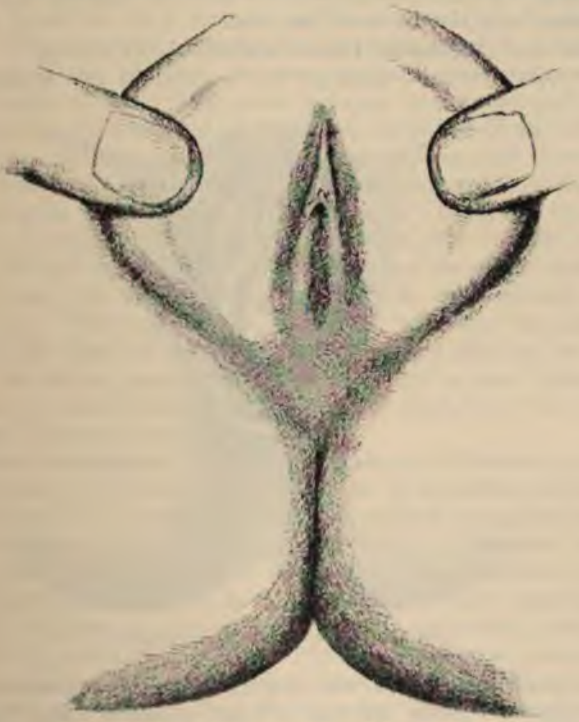

FIG. 51.—Atresia vulvæ superficialis. (After Rauschning.)

ABNORMAL COMMUNICATIONS OF THE VULVA.—It will be remembered that during development there is a time when the allantois (bladder), Müllerian ducts (vagina), and rectum all open into a common cavity, which in its turn opens on the surface of the body, and is called the cloaca. Normally this condition is transitory; but in certain cases it is permanent, and thus the anomaly known as *atresia ani vaginalis* or *vulvar anus* is produced. In other cases development has advanced a stage further before it is arrested; the perineal partition has grown downwards and separated the rectum, which now opens externally at the anus, from the rest of the cloacal cavity, which is now known as the *urogenital sinus*. The persistence of the urogenital sinus, into which bladder and genital ducts open, gives rise to the anomaly known as *hypospadias* in the woman. Female epispadias, a somewhat puzzling and very rare malformation, may also be described here.

Atresia ani vaginalis (Anus vulvalis). — *Pathology.* — The term "*Persistent cloaca*" ought, perhaps, to be given to this anomaly, rather than the cumbersome and not strictly accurate expression "atresia ani vaginalis." "*Anus vulvalis,*" "*anus vaginalis,*" and "*anus vulvo vaginalis,*" are also names which have been applied to this malformation. Apparently the normal anus is absent, and the rectum opens into the vagina or the vulva (Fig. 52). Strictly, however, by imperfect downgrowth of the perineal partition, the rectum opens not into the vagina or vulva, but into the urogenital sinus. I have seen a case in which there were *two* vulvar anal openings between the posterior commissure and the hymen; there was a dimple where the normal anus ought to have been.

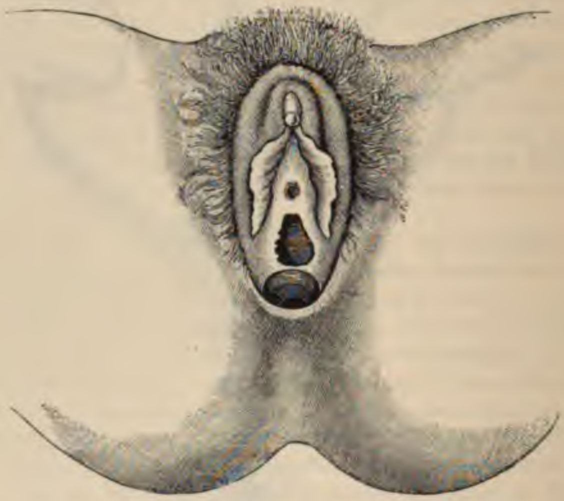

FIG. 52.—Anus vulvalis. (After Dwight.)

Clinical features. — The chief symptom of this anomaly is the passage of the fæces through an opening either in the neighbourhood of the vestibule or in that of the posterior commissure. In some instances, when there is a sphincter, the patient has control over the fæces; but in other cases there is no such control. In the latter case the external genitals, which are kept constantly moist, are apt to be sore. So uncomfortable is the patient thus rendered, that she gets into the habit of promoting constipation, so that emptying the bowels may become a weekly instead of a daily act. When there is control over defæcation there is not any pressing need for operative interference; but after each motion the sinus urogenitalis ought to be douched. When, on the other hand, there is fæcal incontinence it will be necessary to operate; and the age when interference is most likely to be successful is that of fifteen years or later, when the fæces are fully formed and the tissues can be more easily moulded. The usual operation consists in the passage of a probe through the fistula, and the bringing of it out in the position where the anal aperture ought to be. The parts between the probe and the skin surface are then to be divided, and the rectum pulled down and sutured into position. As, however, by this means a permanent cure can very rarely be obtained, Buckmaster has recently advocated a modification of the operation. He advises that the probe should be brought out, not in the position where the anus should be, but in front of it, just above the levator ani muscle. Then the tissues above the probe are to be divided, and the rectum drawn to the skin and fastened there, but without strain. The raw surfaces must then be sewed together. At a later period the fibres of the levator ani are to be split, as are those of the rectus muscle in gastrostomy, in order to get a good sphincter. It remains to be seen whether this method of operation will yield more satisfactory results than the older one.

Persistent urogenital sinus (Hypospadias in Woman).—*Pathology.*—In one sense it is incorrect to speak of hypospadias in the woman as an anomaly, for the normal woman, as regards her external genitals, may be called a hypospadiac man. There is, however, a malformation of the female genitals to which this name has been commonly given. Properly speaking, it is a persistence of the urogenital sinus; the urethra appears to open into the vagina: but what is regarded as vagina is really sinus urogenitalis. Through a common opening at the base of the clitoris, which, it may be remarked, often shows hypertrophy, both the urine and the menstrual fluid escape. The perineum is normally formed, and the rectum opens separately behind it at the anus. Thus the condition differs from the persistent cloaca of atresia ani vaginalis. Of hypospadias in the female subject, Pozzi describes two varieties differing in degree. In one, which represents the minor degree, the vestibular canal is long and narrow, and receives the opening of the urethra and vagina fairly high up; very frequently this type is accompanied by a hypertrophy of the clitoris, and thus a condition of parts is produced which may give rise to some doubt as to the sex of the individual. In the second degree, which may be called hypospadias proper, the urogenital canal has disappeared; there is thus absence of the urethra, and the vagina and bladder open together into the vestibular canal; so that it appears as if the bladder opened directly into the vagina. Cases of this kind have recently been reported by Strong and Frank. There will be incontinence of urine.

Epispadias in Woman.—*Pathology.*—Epispadias, as a defect of the upper wall of the urethra is called, may occur alone; or it may be associated with malformations of the bladder and anterior abdominal wall. In the former case the urethra is seen as an open groove passing upwards in the position of the vestibule, and disappearing under the symphysis pubis, to end directly either in the bladder, or in the upper and closed part of the urethra; for the defect may be present only in part of the canal. On each side of it lies one-half of the split clitoris, and attached to each half is the upper end of one labium minus. The labia majora may unite normally in front or may diverge. The bladder is closed in anteriorly, and there is usually no separation of the symphysis pubis; it is, however, broader than normal. The growth of hair in the median line of the mons veneris may be defective, as in a case of female epispadias seen by myself. The bladder cavity is commonly diminished in size. In the other form of epispadias the anomaly is complicated by ectopion vesicæ (extroversion of the bladder) and by a failure of union of the arcus ossium pubis. In this case the upper ends of the labia majora are wide apart, and the urine escapes directly from the ureters. Sometimes it is not the bladder which is thus open to the front, but the cloaca—development not having proceeded so far as to form a separate bladder. Intermediate types may be found between those two varieties, the simple and the complicated; and these serve as connecting links. It is with the first variety, however, that we have here specially to do. Epispadias is much rarer in the female than the male subject—a circumstance which has not yet found a satisfactory explanation. Whether the anomaly be due to the rupture of parts already fused together, or to the failure of union of structures which normally grow together, has not yet been definitely settled. Durand seems to connect it with an imperfect formation of what Tourneux terms the "bouchon cloacal"; or it may be due to rupture of the cloacal membrane which forms the anterior boundary of the entodermal cloaca.

Clinical features.—The most important clinical manifestation of uncomplicated epispadias is incontinence of urine. The incontinence is not usually complete, but any sudden movement or change in position is followed by a gush of urine from the small bladder. As a result the external genitals are kept constantly wet, erosions soon appear upon them, and the condition of the patient is most distressing. Menstruation, however, commonly occurs normally, and the woman may become pregnant and bear a child. The cure of the condition is, therefore, urgently called for, and by paring the edges of the parts, and uniting them by sutures, a good result is sometimes obtained. In many instances, however, the operation fails for want of sufficient tissue, or on account of breaking down of the union artificially brought about. In such cases we have to fall back upon the use of a carefully fitted urinal, by means of which the patient's condition is rendered bearable. This was all that could be done for the case seen by me.

MALFORMATIONS OF THE CLITORIS AND LABIA.—*Pathology.*—It has been shown in the preceding pages how the vulva may be malformed in all its component parts; but it must now be added that each of the external genital organs may alone be the subject of an anomaly. The clitoris, for example, may be entirely wanting. This happens sometimes in connection with epispadias; but it is then more usual to find it bifid. Possibly split clitoris in the female is homologous with the rare cases of bifid or double penis in the male subject. In some cases the clitoris is found to be poorly developed, but it is more common to observe hypertrophy of it. This enlargement is doubtless more often acquired than congenital, and it is then associated with self-abuse; but it may also be present at birth, usually in association with persistence of the urogenital sinus, or with uterine malformations. When hypertrophy of the clitoris is also combined with labial hernia of the ovaries, the resemblance which the individual bears to the male type is very marked.

The labia majora may be absent, but this defect is nearly always associated with ectopia vesicæ.

They may also be adherent to each other, as has been already pointed out under the head of Atresia vulvæ superficialis or Conglutinatio labiorum. The labia minora may also be glued together, and probably this accounts for some of the cases in which they were said to be wanting; they may be truly absent, nevertheless, in connection with epispadias. It has been stated that they may be increased in number, two or three folds having been found in place of one; it is quite certain that they may be increased in size, and the deformity called the "Hottentot apron" is well known.

Clinical features.—Enlargement of the clitoris and labia gives rise to irritation in the neighbourhood of the external genitals, and may thus be the cause of self-abuse and of nervous troubles. On this account it may be necessary to amputate the clitoris, or to excise the nymphæ.

MALFORMATIONS OF THE HYMEN.—Many of the malformations of the hymen have little clinical importance, although they are all of interest from the pathological standpoint, and some of them have a bearing upon medico-legal questions. There is as yet no general acceptance of any one explanation of the mode of development of the hymen: some writers assert that it is vaginal, others that it is vulvar in origin; but as it may be present when the vagina is absent, and may even be found in hypospadiac males, the facts are strongly in favour of the latter hypothesis. Indeed, Pozzi, by whom these facts have been prominently enunciated, regards them as conclusive. At any rate, the hymen is to be looked upon, not as a "fixed" organ, but as a developmental remnant; it shows, therefore, a very large number of small anomalies as regards structure, form, and position. It consists really of three parts, which Pozzi has named *hymen proper*, *pad of the meatus urinarius* or *urethral hymen*, and *male bridle of the vestibule*. All these parts I have been able to recognise in the new-born infant; although in the adult they are not very distinct. It would seem that the urethral hymen, like the hymen proper, may present abnormalities; and in an infant at birth I have seen an occlusion of the meatus urinarius, by what I regarded as a fusion of the two lateral parts of the pad of the meatus, or hymen urethræ.

Double Hymen.—The cases of double hymen which have been reported are probably errors of interpretation. What is called a supplementary hymen is usually a perforated diaphragm in the vagina a little above the level of the normal hymen. Two or even three of these diaphragms may exist, and they are possibly due to adhesions formed between the vaginal walls in fœtal life. Of course in the rare cases of double vulva there may be two hymens, but this is not what is usually meant by "double hymen."

Absence of the Hymen.—Absence, like duplication of the hymen, is an anomaly whose occurrence is not well established. In the infant at birth the membrane often consists of two pouting lateral folds which may easily be mistaken for the labia minora; and in this way the notion arises that the hymen is absent. Further, in certain cases, especially in the negro race, the hymen is situated deeply, because the vestibular canal is longer than normal; and here again the membrane may seem to be wanting. The medico-legal bearing of these facts in connection with the question of rape is evident.

Atresia hymenalis.—*Pathology.*—The occurrence of imperforation of the hymeneal membrane is probably not nearly so common as the large number of reported cases would seem to show. Undoubtedly genuine examples of atresia of the hymen are occasionally met with; but in the majority of the recorded cases there is evidence to lead us to suspect that the membrane supposed to be hymeneal was really the blind end of the Müllerian vagina. It is often possible, as Matthews Duncan and others have shown, to find the normally perforate hymen pushed backwards and hidden to some extent by the bulging of the vaginal sac. Strictly speaking, cases of hymeneal atresia are often instances of atresia of the lower part of the vagina; or, as some prefer to name it, of the *retro-hymen*. In another group of cases adhesion of the labia minora gives rise to an appearance resembling atresia of the hymen; and it is only when the labial attachment has been divided that the hymen is seen lying beneath. The pathological results of all these conditions are the same: there is retention of vaginal mucus in infancy, and of menstrual fluid in later life, with consequent occurrence of hæmatocolpos.

Clinical features.—In the position of the vaginal orifice is found a bulging membrane, sometimes of a bluish colour, which in some degree resembles the intact bag of membranes in labour, and has even been mistaken for it. This swelling has gradually increased from the time of puberty, and its appearance has been accompanied by colicky pains recurring with increasing severity at intervals of a month, and by the absence of the menstrual discharge. Sometimes, also, the evacuation of the bladder and bowels has been rendered difficult and painful; and in a few instances there have been vicarious menstrual hæmorrhages. In advanced cases a fluctuating abdominal tumour has appeared, the result of distension of the vagina with blood. On the top of this swelling a small hard mass can sometimes be detected; this is the undistended uterus. In other cases this organ also has become a blood-sac, and in such cases hæmatocolpos and hæmatometra coexist.

Operative interference is always required in these cases, for spontaneous external rupture is uncommon; even when it occurs it is unsatisfactory, the evacuation being incomplete, and often followed by suppuration in the vaginal cavity. It used to be the custom to puncture the imperforate hymen at one sitting, and then later to make a crucial incision, and fully evacuate the contents; for it was thought that the sudden escape of the vaginal contents might be attended by dangerous results. But this method is apt to be followed by suppuration; it is best to make first a small incision so as to allow the blood slowly to escape, and then at the same sitting to enlarge the opening, to wash out the canal thoroughly with an antiseptic lotion, and finally to pack it firmly with iodoform gauze.

Anomalies in the form of the Hymen.—Many anomalies in the form of the hymen may be met with, but they are of comparatively little practical importance. Instead of having its normal crescentic or semilunar shape, it may retain its infantile character; it then shows two lateral projecting lips, which have sometimes been mistaken for the nymphæ; this form is called *labiated* or *infundibuliform*. Sometimes notches occur naturally in the membrane, which then is called the *hymen denticulatus*; it is necessary to remember the occurrence of these folds or notches, and to distinguish them from the rents produced by coitus or labour. Rarely the *fimbriated hymen* is met with; the orifice is usually situated nearer to the anterior than to the posterior border of the membrane; but occasionally it is quite central—*hymen circularis*. Further, the opening may be very large (*falciform*), or there may be two orifices of equal size, situated laterally (*hymen septus*). Yet another form is that in which there are two apertures of unequal size, and situated irregularly (*hymen bifenestratus, hymen biforis*). A very uncommon type is the *cribriform*, in which there are many small holes in the membrane (*hymen cribriformis*).

Anomalies in the structure of the Hymen.—*Pathology.*—The hymen may be abnormally thick, abnormally firm or rigid, or abnormally vascular. It may also show combinations of these anomalies. Thus it may be both thick and vascular, or both rigid and fleshy. To a certain extent these states may be regarded as due to a persistence of the fœtal characters of the membrane, and they are of some clinical importance.

Clinical features.—Abnormal rigidity of the hymen may be the cause of dyspareunia, or it may entirely prevent penetration in the act of coitus. In a case seen by myself it was found necessary to excise the hymen of a newly-married patient before complete connection could be accomplished by her husband. In other cases pregnancy occurs notwithstanding the unruptured state of the hymen; and the presence of the membrane may protract labour, or, if it be torn, may cause a deep laceration also of the perineum. Cases have even been reported in which the hymen has been found intact after a miscarriage; but in these instances the membrane has probably been abnormally elastic, rather than abnormally rigid. The importance of the occurrence from the medical jurist's standpoint is manifest in connection with the question of chastity. Abnormal vascularity of the membrane is also an anomaly of some importance, for, on the first occasion of coitus, it may be the cause of alarming or indeed of dangerous hæmorrhage. All these structural malformations of the hymen are more easily understood if it be granted, as Pozzi affirms, that the hymen is the homologue of the corpus spongiosum of the male.

HERMAPHRODITISM

The exact meaning of the word "hermaphrodite," as applied to the human subject, has undergone a change. The older writers applied the term to individuals whom they regarded as possessing the organs of both sexes in an anatomical and in a physiological sense; but modern authors have come to use the name rather to indicate subjects whose true sex is doubtful. Malformations of the genital organs, giving rise to doubts as to the true sex of the individual, have attracted the attention of observers from the earliest periods of the world's history; and, as I have shown elsewhere (327), records of such cases have been found on the brick tablets of the ancient Chaldean libraries. In Rome individuals of doubtful sex were destroyed. In the East, on the other hand, there is reason to believe that they were deified. According to the Talmud, Abraham was a hermaphrodite; and so, according to many authors, was Adam.

In one sense the human embryo at a certain period of its existence may be regarded as hermaphrodite. There is a stage in development when it is impossible to foresee whether the sexual gland will become an ovary or a testicle; whether the Müllerian or the Wolffian ducts will atrophy; whether the genital tubercle will become a penis or a clitoris. The embryo is then, so far as is known, potentially of either sex, and awaits the action of some force to determine which sex is to predominate. It is easy to understand how morbid influences, brought to bear upon the embryo at or about the time when it is passing from its sexually indifferent stage into one of differentiation, may so upset the normal process of development as to produce an individual with, for example, testicles and a uterus. It is, however, a matter of great difficulty to imagine a condition of affairs which would give rise to the presence of a testicle and an ovary on the same side; but, in order to account for the facts, some explanation must be found. In the Müllerian and Wolffian ducts we have to do with two sets of structures, one of which normally atrophies and the other develops; but abnormally both may persist in a more or less fully formed condition. Genuine cases of coexistence of testicles and ovaries in the human subject are extremely uncommon; but instances of pseudo-hermaphroditism, as they have been called, are far from rare.

Writers have classified cases of hermaphroditism in various ways. Klebs, for example, divides them into two groups: true hermaphroditism, or *Hermaphroditismus verus*, in which ovaries and testicles coexist; and pseudo-hermaphroditism, or *Hermaphroditismus spurius*, in which, along with either ovaries or testicles, there are found some of the genital organs of the opposite sex. Pseudo-hermaphroditism, again, he divides into masculine or feminine, according as testicles or ovaries are present; whatever may be the state of the other reproductive organs. Pozzi to some extent modifies this scheme of classification. He arranges all the cases in three groups: *partial pseudo-hermaphroditism*, in which one sex obviously predominates, only a few of the peculiarities of the other being present; *pseudo-hermaphroditism properly so-called*, including a large number of cases chiefly of the variety known as male hypospadiacs; and *supposed true hermaphroditism*, in which both kinds of sexual glands have been regarded as present. It does not seem theoretically necessary to make a distinction between pseudo-hermaphroditism and the partial variety, although practically the separation may be of value. The scheme here adopted is that which groups all the cases into pseudo-hermaphrodites and supposed true hermaphrodites, with certain subdivisions which will be stated under each head; and I have added a new variety, or rather have resuscitated an old one, in which the external genitals of both sexes seem to be present in the same individual. Something will first be said regarding the cases which have been reported as instances of true hermaphroditism, and then the large group of the pseudo-hermaphrodites will be considered.

SUPPOSED TRUE HERMAPHRODITISM.—Klebs has divided true hermaphroditism into three groups: *bilateral* (or *vertical*), in which an ovary and a testicle are found on both sides of the body; *unilateral*, in which an ovary and a testicle coexist on one side, whilst on the other side is an ovary or a testicle, or neither; and *lateral* (or *alternate*), in which the female gland is present on one side and the male on the other. All the cases in which there is no report of a post-mortem examination are, of course, useless in classification; for the whole value of such reports consists in the recognition by the naked eye and microscopically of two glands, one of which must have the characters of the ovary and the other those of the testicle. It cannot even be safely asserted, as was done by Rokitansky in the case of Catherine Hoffmann, that the allegation of a menstrual discharge is a proof of the existence of ovaries.

Indeed there is evidence to show that the adult subjects of these abnormalities will intentionally mislead the observer concerning such phenomena as menstruation.

The case reported in 1870 by C. L. Heppner of St. Petersburg has been regarded by many authors as a genuine example of *hermaphroditismus verus bilateralis*; for in it were described a uterus with ovaries and tubes, and on each side also a rounded body in the neighbourhood of the ovary which had the microscopical characters of the testicle. The external organs were like those of the woman. Now, with regard to this case, it must be borne in mind that the parts had been preserved for some time in spirit before they were examined; and that the microscopical appearances of the so-called testicles might easily be regarded as those of immature or undifferentiated ovaries. The arrangement of tubes packed with cells, as depicted by Heppner, seems to me to suggest a mal-developed ovary as much as a testicle. The probability is that the so-called testicles were really accessory or constricted ovaries—bodies which, as has already been stated, often show a structure made up almost entirely of Pflüger's tubes. The case examined by H. Meyer, and reported by Cramer in 1857, is one of a considerable number (including those of Obolonsky and Schmorl) in which true hermaphroditism of the *lateral variety* was alleged. In this instance there was a rudimentary uterus and a vagina, and, on the right side, a normal ovary, parovarium, and tube. On the left side were a tube, a parovarium, and a body herniated in the left scrotal sac, and supposed to be a testicle. Cramer does not give the detailed microscopical appearances of this body; but it seems more rational to regard it as an ovary, possibly in a rudimentary state, which had descended into the left labium, than as a testicle. Blacker and Lawrence have described an apparently genuine case of *unilateral hermaphroditism*: it was that of a fœtus with a uterus unicornis, a normal tube and ovary on the right side, and an ovo-testis on the left. The ovo-testis had an ovarian part in which were cell columns, cell nests, and Graafian follicles, and a testicular part containing definite tubules filled with cells and an abundant stroma. It may, therefore, be admitted that evidence is gradually accumulating to prove the possibility of true *anatomical* hermaphroditism in the human subject; of cases illustrating the presence of two kinds of genital glands both showing *functional* activity there is as yet no indication.

PSEUDO-HERMAPHRODITISM.—*Pathology.*—Cases of pseudo-hermaphroditism are not uncommon, as a glance at the appended bibliographical list will serve to show. In many of them the dubiety is evidently due to the existence of one or other of the anomalies of the female external genital organs which have been already described. In many more, however, we have to deal with malformations of the penis and scrotum, which have given to the external parts a somewhat feminine appearance. In the former group of cases the ovaries are present, whatever may be the condition of the other organs; and the individual is therefore really a female in the state known as *pseudo-hermaphroditismus femininus* or *gynandry*: in the latter group possession of the testicles makes the subject a male, however closely he may approach the other sex in appearance, a state known as *pseudo-hermaphroditismus masculinus* or *androgyny*. Individuals of the second kind are far commoner than those of the first. Each of these two varieties has been subdivided into three groups—*internus*, *externus*, and *completus*. Thus in a case of pseudo-hermaphroditismus masculinus internus there are testicles in association with external genitals of the male type, and a uterus, vagina, and even tubes. In pseudo-hermaphroditismus masculinus externus there are also testicles, but the external genitals and the build of the body are feminine. Again, in pseudo-hermaphroditismus masculinus completus seu externus et internus there are testicles, but there is also a uterus masculinus with tubes; and the external organs approach more or less closely to the female form. In the same way in the three varieties of feminine pseudo-hermaphroditism there are always ovaries: but in the internal type there are also distinct traces of the Wolffian ducts; in the external type the external genitals are of the male form; and in the complete type the external organs are masculine, and the Wolffian ducts and prostate gland are present. The enumeration of these varieties will have given the reader some idea of the morbid anatomy of pseudo-hermaphroditism: at the same time it must be borne in mind that some of them are very rare; one of them, on the other hand—pseudo-hermaphroditismus masculinus externus—is, comparatively speaking, very common.

One of the most usual arrangements of parts to which the name of feminine pseudo-hermaphroditism is given is that in which a woman presents an adhesion of the labia along with hypertrophy of the clitoris. When, also, there is a labial ovarian hernia on one or both sides, and a development of hair on the face, the resemblance to the male, at any rate to the hypospadiac male, becomes very striking. The vulva, however, may be normal, and the subject show simply an enlarged clitoris, a beard, and a masculine arrangement of the pubic hair, as in the case of Zefthe Akaira (La Donna-Uomo), described by Zuccarelli in Italy. Examples of this kind of gynandry might be multiplied.

Non-descent of the testicles in the male gives origin to one variety of androgyny. Such men are often the subjects of gynæcomastia (enlargement of the breasts); and since also the penis, although perforate, is sometimes small, and the sexual functions poorly developed (infantilism), it is easy to understand how doubts as to their virility may arise. A more common type of androgyny, however, is that caused by the existence of scrotal hypospadias (Fig. 53). In this case the resemblance to the female type of external genitals is very strong, for there is a small imperforate penis often fixed in position under the symphysis by adhesions; the urethra opens externally near the root of the penis, and below it is a sort of vulvar aperture or vestibular canal which may even be of some depth, and may be guarded by a hymen. The external genitals in such a case resemble, as Pozzi graphically expresses it, those of an embryo seen under a magnifying glass. When it is also borne in mind that the testicles are either undescended or at any rate atrophic, and that the individual has probably been mistaken for and brought up as a girl, and has thus acquired feminine habits, it is easy to see how extremely difficult it may be to ascertain the real sex. The difficulty may be still further increased by enlargement of the mammæ, by the absence of hair on the face and chest, and by the occasional discovery of a uterus; although, of course,

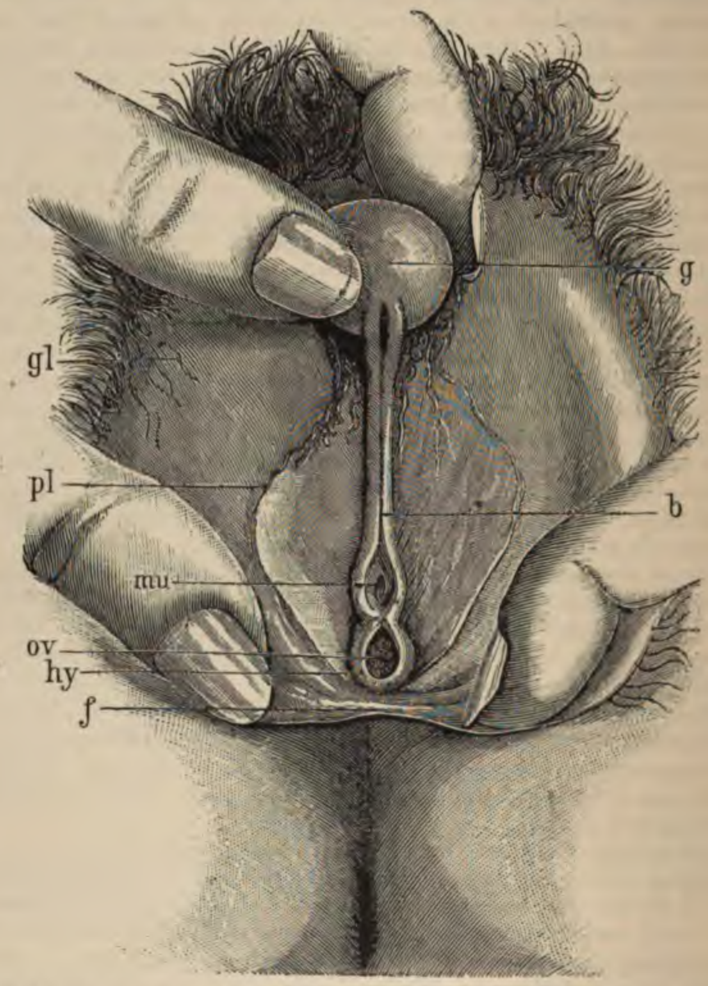

FIG. 53.—Pseudo-hermaphroditism, perineo-scrotal hypospadias. (After Pozzi.) *g*, Glans; *b*, frænum; *mu*, meatus urinarius; *ov*, vulvar orifice; *hy*, hymen; *f*, fourchette; *pl*, labia minora; *gl*, labia majora.

ovaries are not to be detected. Doubtless most of the cases of supposed true hermaphroditism have been really hypospadiac men.

A word or two may here be said regarding a form of pseudo-hermaphroditism not recognised by recent writers. In very rare instances individuals otherwise apparently single show complete duplication of the vulva or the penis. In an article, published in 1895, I showed that in some of these cases of diphallus one penis only may be perforate, the other being small, and presenting an opening below it through which urine escapes. Such a case might easily be regarded as an instance of the coexistence of both male and female external genitals; and possibly some of the discredited accounts of persons provided with a vulva and a penis, reported by early writers, may have belonged to this category. Similarly in individuals with a double vulva the enlargement of one clitoris might give rise to a similar notion; and probably the case of an infant, seen by Moostakov, in which there were on one side external genitals of the female type with a perforate urethra, and on the other an imperforate penis (?) and a scrotum without testicles, may have been of this kind. A somewhat similar case was seen by Neugebauer of Warsaw. The condition might be called *external pseudo-hermaphroditism*, had not this name been already appropriated to another type of genital anomaly.

Clinical features.—Whilst in the histories of pseudo-hermaphrodites there are many details which are peculiar to each case, there are also some which are practically common to all. The error in the recognition of the true sex of the individual is usually made at birth and confirmed at baptism; and, as a rule, it is not till the period of puberty is reached that doubts of the accuracy of the declaration at birth begin to prevail. In the case of male pseudo-hermaphrodites the error may even be perpetuated still longer, and the individual may be married as a woman and live with a husband, an imperfect form of coitus taking place per urethram. Usually, however, suspicions begin to be entertained at puberty when, in the case of hypospadiac males who have been brought up as females, the failure of the establishment of the menstrual function and the appearance of certain of the secondary sexual characters proper to the male sex give rise to doubts. At the same time, it must be borne in mind that even in these subjects hæmorrhage simulating the menses may take place from the urethra dilated by coitus, and in a few instances a real catamenial discharge from a uterus has been noted. Further, the secondary sexual characters cannot be relied upon; for mammary enlargement, rounded outlines, a broad pelvis, a small larynx, and a feminine distribution of the body-hair, may all be met with in male pseudo-hermaphrodites, whilst the secondary sexual characters of the male may coexist with ovaries. The habits, also, and the feelings and desires of the subject, will depend largely on the surroundings of early life, and cannot be regarded as diagnostic of the sex. Pseudo-hermaphrodites are generally sterile; for the sexual glands are often mal-developed, and even when they are active the anomalies of the other organs prevent the successful accomplishment of the reproductive act. Mental and moral weakness and even insanity are not uncommon;

and in the case of Alexina B., so graphically recorded by Tardieu, the individual, a hypospadiac male, committed suicide. Many of the so-called "degenerates" show anomalies of the genital organs. That the condition may be hereditarily transmitted is probable; at any rate family prevalence is not uncommon, and J. Philips has reported four cases of pseudo-hermaphroditism in one family, and Lindsay has seen three. I am also acquainted with a case in which two hypospadiac males, the children of one mother, have been brought up as sisters.

The treatment of such cases presents many puzzling problems. Lawson Tait's rule that every infant about whose sex there is doubt should be brought up as a male is a good one; for male pseudo-hermaphrodites are more common than female, individuals reared as males are not so apt to enter into marriage in ignorance of their sexual inability, and there is less danger in bringing up a girl among boys than a boy among girls. The question of the advisability of surgical interference is a difficult one. In a case reported by Christopher Martin, the testicles were removed from an individual brought up as a girl, and castration was followed by a development of the breasts and pubic hair; whilst Péan records the extraordinary operative history of an individual whose abdomen was first opened to discover the sex, then an artificial vagina was made, and finally the abdomen was again opened and the tubes and ovaries removed. The division of a tight frenum in a hypospadiac male, and the separation of the adherent labia in a gynandrous individual, are minor operations which may be undertaken without hesitation; but it is doubtful whether we are justified in removing the sexual glands in any case of pseudo-hermaphroditism, although of course the alternative procedure of making a redeclaration of sex (as was done in the case reported by Halliday Croom in 1899) is also attended with difficulty and great inconvenience. Possibly it may be well to consider the advisability of the establishment of a third class of individuals, who shall be regarded as neuter.

The medico-legal bearings of hermaphroditism are self-evident. The questions of identity, of paternity, of the right to exercise the franchise, and to enter professions open only to one sex, when the individual is one about whose true sex there is some doubt, all require very careful consideration and clinical investigation. Moreover, the legality of a marriage between a man and a hypospadiac male cannot be maintained; and one between a woman and a gynander is equally against the law. In a text-book of gynæcology further consideration of these matters is not necessary.

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DISPLACEMENTS OF THE UTERUS

Even in perfectly normal conditions the uterus is liable to vary greatly in its relations to the pelvic cavity in which it lies. These relations are modified by its own functional activities, as well as by the distension and evacuation of the adjacent viscera. We may consider it as placed in the pelvis: (A) as regards its Level, so that the fundus corresponds more or less to the plane of the brim, and the os externum points to the coccyx in the plane of the ischial spines; (B) as regards its Position, so that it lies nearly midway between the symphysis pubis and sacrum, and between the two sides of the pelvis; and (C) as regards its Direction, so that its axis corresponds more or less to the axis of the pelvis. Thus we may find it in moderate degrees of distension of the bladder and rectum. Let these organs, however, be fully distended, and the uterus will be raised above the level which we have assigned to it. Let the bladder alone be distended, and the uterus will be carried back beyond the middle line of the pelvis. Let the bladder be emptied, and the uterus will fall forward so that its fundus comes close to the symphysis pubis. It is in this position that it is most frequently found on bimanual examination (see Fig. 54).

With this wide range of physiological mobility it keeps its place by virtue of: (i.) the insertion of the supravaginal portion of the cervix in the upper end of the vagina, where it rests upon the tip of the sacrum and coccyx in the pelvic floor; (ii.) the action of the utero-sacral ligaments, which keep the isthmus in its proper relation to the upper part of the hollow of the sacrum; (iii.) the utero-vesical ligaments, which maintain its relation to the bladder and symphysis pubis; (iv.) the broad ligaments on each side, which especially regulate its lateral movements; and (v.) the round ligaments, which keep the fundus directed upward and forward towards the inguinal canals. When it fails to retain its equilibrium, either in the way of excess of movement beyond its normal range, or of losing the power to recover its normal relations, its displacements become pathological, and give rise to troubles that lead the patient to seek for medical advice.

In a large proportion of cases the displacement will be found to be not simple, but compound. Thus, where there is a downward deviation from the ordinary level, and the uterus is prolapsed, there is usually also a loss of its normal direction, and the uterus is retroverted. But it is the downward displacement that is the most important element in the case, and which most urgently calls for rectification. Again, in many cases an anteflexed uterus may be found lying close to the hollow of the sacrum in a state of retroposition; and it may require careful analysis of the conditions before the practitioner can decide which of the two deviations—the deviation in direction or in position—is the more chargeable with the patient's sufferings. We will study, however, the different displacements in succession and consider:—

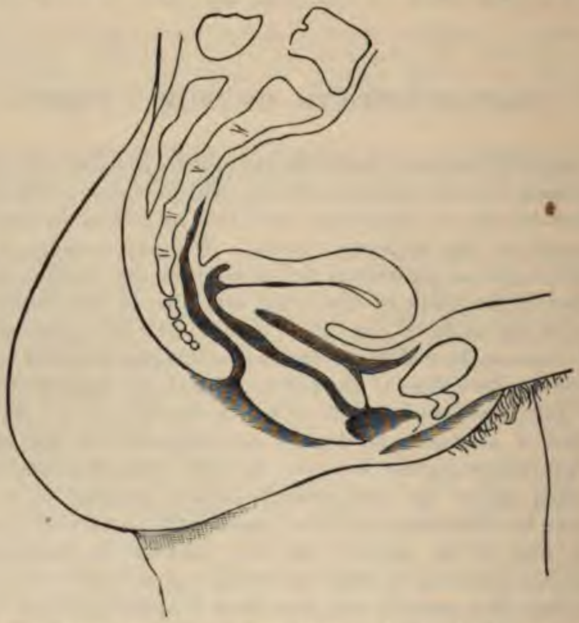

FIG. 54.—Normal anterior inclination of uterus, bladder and rectum being empty. (Schultze.)

A. DEVIATIONS FROM THE NORMAL LEVEL

The uterus may be moved beyond the planes of the pelvis, within which it normally ranges, either upwards or downwards.

I. ASCENT OF THE UTERUS.—In the elevations or upward displacements of the uterus, the organ is lifted off the pelvic floor, and the fundus rises above the pelvic brim so as to be accommodated to a greater or less extent in the abdominal cavity. The gravid uterus, say from the third month onwards, grows gradually and at a steady rate higher and higher in the abdomen. So when the unimpregnated uterus becomes the seat of a large myoma, it may have become largely an abdominal organ before it comes under observation. When a tubal gestation goes on developing beyond the early months; when an ovarian or parovarian tumour grows down into the broad ligament or becomes fixed behind the uterus; when an effusion or extravasation is encapsuled in the pouch of Douglas; or a tumour grows in the rectal wall;—in all these and similar cases the uterus may be lifted or pushed upwards: and even in some peritonitic cases the fundus may have acquired adhesions which drag it towards the abdomen. The ascent of the uterus under such circumstances, however, is only a bye-phenomenon. It may be of vital importance to recognise the abnormal position, and our successful treatment of the patient may depend on its detection; but elevation of the uterus does not present itself to us as an isolated occurrence, and the symptoms associated with it are subsidiary to those of the condition which brought it about. It is quite otherwise with the downward displacements, which we now proceed to consider.

II. Descent of the Uterus.—Prolapsus or procidentia uteri—falling down or protrusion of the womb—are names that have been used to express the downward displacement of the uterus, which leads to its escape from the pelvic cavity till it comes to lie externally to the pudenda. It must be recognised at once that here the dislocation of the uterus is not an isolated phenomenon. As the organ sinks in the pelvis it drags with it its adnexa, the Fallopian tubes and ovaries: its depression is followed by depression of the superincumbent coils of the intestines; and, even if in the early stage of the process the vaginal walls with the bladder and rectum may have retained somewhat of their normal position, in the more advanced stages these have all moved downwards to such an extent that the vagina has become completely inverted. We have to do, therefore, with a hernial process, the pelvic contents escaping through the oblique fissure in the pelvic floor, which we think of as the vaginal canal, until we have a sac, the covering of which is formed by the inverted vaginal walls, and the contents of which consist of the body of the uterus and the adjacent viscera. The displacement may begin at the upper, uterine extremity of the fissure, or at the lower, pudendal extremity; or the favouring conditions may operate simultaneously throughout the whole pelvic floor. But in any case the displacement of the uterus is the central element in the disturbance; its functional troubles are prominent among the attendant symptoms; and the treatment must have regard to its reposition and its retention in its proper place.

The displacement may be met with at different stages, so that a distinction has been drawn between the different degrees of descent.

Degrees of Descent.—i. In the simplest cases the uterus has only sunk downwards to a slight degree from its ordinary level, the fundus lying distinctly below the brim of the pelvis, and the os low on the pelvic floor; but it retains its ordinary position in the middle of the pelvis, and the fundus has its ordinary anterior inclination. ii. In a second group of cases, where the prolapse is still incomplete, the uterus has sunk still lower, with the os resting on the anterior margin of the perineum, or appearing at the pudendal fissure, and the fundus is found at a varying height according to the size of the organ. In this variety the uterus has undergone a change in the direction of its axis, and has fallen backwards towards the hollow of the sacrum, so that it is not only in a state of prolapse, but at the same time of retroversion or retroflexion. iii. In cases of complete descent the whole organ has sunk so low that it projects within the inverted vagina completely beyond the pudendal orifice ; and in this situation the body is usually found retroverted, though in rare cases the fundus may be directed upwards or forwards. It has sometimes been proposed to distinguish the varying degrees of descent by speaking of the incomplete varieties as cases of prolapsus, and the complete variety as procidentia uteri. The names, however, are not distinctive ; and whether we call the descent prolapse or procidence, we must distinguish between the cases where the uterus is still within the vaginal cavity, and those where it is entirely extruded, by speaking of the former as incomplete and the latter as complete prolapse. In the case of incomplete prolapse, we have the two sub-varieties : (*a*) incomplete prolapse of normally-inclined uterus ; and (*b*) incomplete prolapse of retroverted uterus. In the case of complete prolapse the direction of the uterus is of minor moment.

Pathological Anatomy.—If we look more carefully at the structures protruding through the vulva, we shall find we have to do with different elements of the pelvic contents in different cases. In all the cases the vaginal walls have become dislocated, but as regards other viscera we find in some—

i. *Chiefly displacement of uterus.*—The tumour projecting through the vulva is covered completely with the inverted walls of the vagina, which have lost their rugosities and present a smooth appearance. The os uteri may be seen at the lower anterior part, where the cervix barely projects beyond the general surface of the tumour ; and through the walls, the body of the uterus with its adnexa, and occasionally some intestinal coils, can be felt occupying the hernial sac.

ii. *Chiefly displacement of bladder.*—Sometimes the projecting structure is constituted mainly by the descent of the anterior wall of the vagina, carrying with it the back wall of the bladder. The case is one of cystocele. In this condition the uterus may be only in the first stage of incomplete descent, and remain functionally active. If the uterus become gravid, the cystocele may be aggravated and become a source of trouble during pregnancy and labour, whilst the uterine displacement is for the time undone. This prolapse of the anterior vaginal wall, however, is more apt to become associated with hypertrophic changes in the cervix uteri which lead to more complete prolapse of the whole organ.

iii. *Chiefly displacement of rectum.*—In rarer instances it is the back wall of the vagina that projects through the vulva. The case is one of rectocele, so-called, or proctocele.

iv. *Cystocele with hypertrophy of intermediate portion of cervix uteri.*—The circumstance that the vaginal mucosa is attached to the cervix low down in front at about one-third of an inch from the anterior lip, whilst behind it passes up to within about one-third of an inch from the isthmus, has led to the convenient distinction of the cervix into the three segments (see Fig. 55). Below, we have the vaginal or infravaginal portion, lying entirely free in the vaginal cavity below the level of the anterior fornix; above, we have the supravaginal portion embraced by parametrium and lying entirely above the level of the posterior fornix; between these is the intermediate portion lying above the level of the anterior, and below the level of the posterior fornix. On its posterior aspect this intermediate portion lies free in the vagina; its anterior surface lies above the vaginal reflection, and is in contact with the areolar tissue which separates it from the bladder wall. This intermediate portion undergoes a remarkable degree of hypertrophy and elongation in cases where the anterior wall of the vagina has been displaced. The vesico-vaginal septum that has been exposed through the vulva becomes congested and thickened, and is the seat of a hyperplasy that extends to the portion of the cervix with which it is in intimate vascular relations (see Fig. 56).

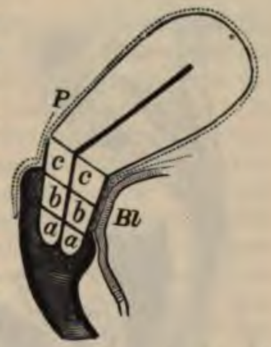

FIG. 55.—Division of cervix uteri into three portions—*aa*, *infravaginal* portion, entirely below vaginal mucosa; *bb*, *intermediate* portion, above vaginal mucosa in front and below it behind; *cc*, *supravaginal* portion, entirely above vaginal mucosa. *Bl*, Bladder; *P*, peritoneum. (Schroeder.)

v. *Cystocele and Proctocele, with hypertrophy of the whole supravaginal portion.*—In many cases where the cystocele alone exists in a marked degree, the hypertrophy may affect the whole supravaginal portion of the cervix. Such a hypertrophy is more certain to be produced when the posterior as well as the anterior vaginal wall has escaped through the vulva. In such a case the protruded mass has a large segment of the bladder in front and a rectal pouch behind; and is felt to contain only the elongated cervix and isthmus of the uterus, whilst the fundus and its adnexa are still within the pelvic cavity (see Fig. 57).

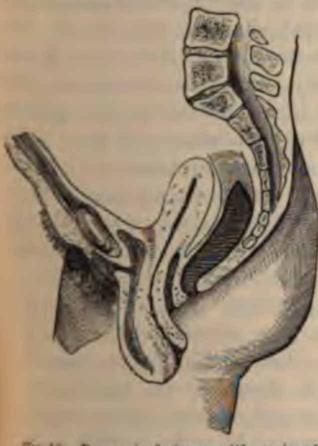

FIG. 56.—Descent of uterus with cystocele and hypertrophy of intermediate portion of cervix. (Schroeder.)

Causes of Prolapsus uteri.—We have seen that the uterus maintains its normal level by virtue of a balance between the structures that sustain it and the forces that tend to depress it. We must look, therefore, for the causes of its permanent descent either, on the one hand, to conditions that weaken its supports, or on the other to conditions that increase the strain upon them. These conditions are (*a*) Passive, and (*b*) Active. Frequently enough these conditions are simultaneously operative in both directions.

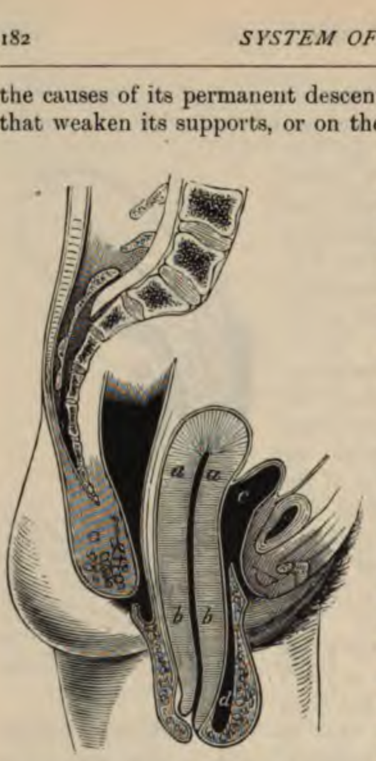

FIG. 57.—Cystocele and proctocele with hypertrophy of the whole supravaginal portion of cervix. *aa*, Body of uterus; *bb*, elongated supravaginal portion of cervix; *c*, upper part, and *d*, displaced part, of the bladder. (Schroeder.)

(*a*) *Passive causes.*—These are to be found in loss of retentive power of the uterine supports, and foremost among the defects that lead to descent of the uterus we must place :—

i. Faults in the perineum.—The integrity of the perineum may be seriously impaired, and yet the uterus maintain its normal place. The whole of the structures between the lower third of the vagina and the rectum may be found lacerated to such an extent that the patient is unable to control the action of the bowels, and comes to seek relief because of this trouble. In such a case the uterus may be found at its normal level, the other sustaining structures being of sufficient strength and tonicity to maintain it in place ; or inflammatory or cicatricial changes may have impaired its mobility. As a rule, however, damage of the perineum or perineal body is a prime element in the weakening of the pelvic floor that eventuates in herniation of the pelvic contents. This damage is usually inflicted during labour, and may take the form either (*a*) of laceration beginning at the fourchette, or on the mucous surface, or even on the cutaneous surface, and running more or less deeply through all the tissues to or into the anal and rectal canal ; or (*β*) of diastasis of the muscular and fascial tissues that meet in the perineal body, and lie between the mucous membrane and the skin. In the latter case no cicatrix is to be seen behind the vaginal orifice. The mucous lining and the skin covering of the perineum have been dilated without being fissured, and the structures seem to be entire ; but when the perineum is grasped between the finger and thumb, or is stretched on two fingers introduced into the vagina, it is felt to be thin and relaxed, and incapable of offering any effective resistance to the pressure brought to bear on it from above. Where the perineum has been thus torn or strained, so that it ceases to afford adequate support to the superjacent structures, the first stage of a displacement is seen in the projection of the anterior vaginal wall through the patulous orifice ; and where other causes are in operation tending to a descent of the uterus, the displacement comes about the more easily and rapidly from the absence of the resistance offered to it by the healthy perineum.

ii. Faults in the vaginal walls.—We have seen that it is through the vaginal canal that the uterus becomes herniated. It is obvious that the varying condition of the vaginal walls will modify the proclivity to the uterine descent. In the cases where the uterus keeps its place, notwithstanding that the perineum is deeply fissured, the anterior vaginal wall and the posterior wall above the seat of laceration are usually found to be healthy. The rugæ are well preserved; the submucous muscular and areolar tissues have retained their tonicity; and freedom from all the leucorrhœal discharges associated with colpitis allows the walls to retain their normal degree of apposition. Where, on the other hand, the vaginal walls have become so distended as to have lost something of their tonicity, and where, in addition, the surfaces are bathed with a discharge due to inflammatory and congestive processes, the walls readily become separated, and the inversion of the canal is facilitated either from below or above. That it more frequently begins from below is due to the frequent initiation of the mischief by the perineal defect which leads to exposure of the lower part of the anterior wall. Every mucous membrane subjected to unusual exposure is apt to become the seat of inflammatory changes, as may be seen in ectropion of the palpebral conjunctiva, or of the cervical endometrium; hence the perineal laceration leading to exposure of the anterior vaginal wall is usually attended with chronic inflammatory changes, that lead to general colpitis with free discharge, and thickening of the tissues, thus favouring the production, first of cystocele and then of a more complete prolapse.

iii. Faults in uterine ligaments.—In some instances we trace the descent of the uterus, not so much to loss of power in the structures that support it from below, as to inefficiency of the structures that should retain it above. It is the relaxation of all its ligaments, utero-sacral and utero-vesical, broad and round, subsisting for some time after parturition, that facilitates the sinking down of the uterus which is so apt to be initiated during the puerperium. When these ligaments remain permanently relaxed and strained, a more decided and permanent descent of the uterus ensues.

iv. Faults in the cellular tissues.—In the areolar tissues surrounding the pelvic organs, and filling in the interspaces between the layers of fascia in the different muscular planes, there is found in healthy women a considerable amount of fat. When absorption of this adipose deposit takes place, as in patients who are the subjects of wasting disease, and in some women at the climateric period, a tendency to downward displacement of the uterus and vaginal walls is distinctly traceable. This prolapse may be partly due to weakening of the ligaments, which is not unlikely to be present under such circumstances, but the absence of the normal fatty padding of the pelvis contributes in a notable degree to the result.

v. Faults in the pelvis.—We can understand that the contraction of the brim and expansion of the outlet, characteristic of the rickety pelvis, should favour the descent of the uterus; so that we sometimes find prolapsus uteri in virgins associated with this form of pelvis. In a secondary sense, this and other varieties of malformation become causes of prolapsus in the damage that may be done during labour by the operative procedures which they render necessary. Besides, these changes in configuration are occasionally associated with changes in the inclination of the pelvis; and whenever the inclination of the pelvis is continuously disturbed, and the plane of the brim, instead of meeting the horizon at an angle of about 55°, becomes more or less parallel to it, downward displacements of the uterus are favoured. Such change from the normal inclination occurs in elderly women in whom the anterior curve of the lumbar vertebræ is lost, and in others whose avocations keep them for long periods of time in such attitudes that the promontory of the sacrum, instead of being four inches above the level of the upper margin of the pubic symphysis, is nearly in the same horizontal plane.

(*b*) *Active causes.*—Among the conditions that operate more directly in producing prolapsus uteri we note:—

i. Enlargements of the uterus itself.—In the early weeks of pregnancy, when the uterus begins to grow, it sinks slightly, so that the os is found at a somewhat lower level than in the case of the non-gravid organ. During the puerperium the descent of the uterus, which is rendered possible by the relaxation of its ligaments, is promoted by the increase in its own weight, which persists until its involution is complete. When the involution is interrupted, and the uterus remains enlarged in consequence of the subinvolution, or when it is hypertrophied as a result of chronic metritis, or from the development of neoplasms in its walls, the increase in weight of the organ is among the factors that tend to its depression. For though the hypertrophies of the uterus may sometimes be a result of congestive processes due to its displacement, in many cases the hypertrophy initiates the descent, and in any case favours it.

ii. Distension of neighbouring organs.—Habitual over-distension of the bladder necessarily causes undue pressure on the pelvic floor and undue strain on the ligaments of the uterus with which the bladder is in such intimate relation; it must be regarded, therefore, as among the causes of uterine displacement. In a less degree habitual constipation has a similar effect.

iii. Increase of supra-pelvic pressure.—Of the causes that work actively towards the production of prolapsus uteri, however, the greatest importance is to be attached to those which produce their effect by increasing the pressure that is more or less continuously exerted on the pelvic contents. This supra-pelvic pressure is increased in cases of (*a*) *Relaxation of the abdominal walls.* Such relaxation is more likely to occur in multiparous women, especially where the walls have been overstretched from the presence of unusually large children, or twins, or hydramnios. It may also be found in women who have been subjected to laparotomy for a large ovarian tumour. The abdominal walls are soft and thin, the muscular layers have lost their tonicity, and the so-called "retentive power" of the abdomen is impaired. The abdominal viscera, instead of being retained in their normal relations, tend to sink downwards; and so there comes about a continuous pressure on the pelvic viscera, which promotes herniation through the pelvic floor. (β) In some cases the supra-pelvic pressure is increased from the presence of *tumours in the abdominal cavity*, or of ascitic accumulation in the peritoneal sac. More frequently it results from (γ) Improper kinds of *dress*; as, for example, where the waist is kept constricted by corsets too tightly laced, or heavy clothing is supported on bands round the abdomen. (δ) When a woman is under the necessity of making strong or long-continued *muscular exertions*, the pressure tells upon the pelvic contents; and in cases where prolapsus uteri is said to have occurred suddenly, the displacement is usually attributed to some severe voluntary effort, or to an accident attended with strong muscular effort.

In considering the causes of prolapsus uteri we have to remember that the process of descent is a gradual one. Cases are met with from time to time, where the patient has become suddenly aware of the mischief, and she may tell us that the protrusion was the result of an injury or strain. But when we inquire more carefully into the history, we recognise that, though the last stage of the displacement came on thus rapidly, there had been previous indications of disturbance; and when we make our physical investigation we find traces of long-standing change in the pelvic structures.

We have to keep in view, further, that we have to do, not with the effect of one of the above-named causes alone and independently, or even of one of the groups of causes, but with the combined influence of several of them acting continuously and for long periods. The women who are most subject to this displacement belong to the working classes; and in any individual sufferer the mischief is likely to have begun after a confinement attended by damage to the perineum. The patient, it may be, got up on the second or third day, and had to attend to her child and do her household work; or she may even have been obliged to follow some bread-winning avocation, whilst the womb was still large and its ligaments still relaxed. The passive conditions and the active causes conjoin in such a case to cause the displacement; if they operate month after month, and year after year, perhaps with aggravations from succeeding pregnancies, they inevitably produce a complete prolapse. The influence of any one of the factors may be slight; but it is associated with others which may have arisen independently; and their conjoint influence continues throughout long periods. Hence we cannot learn much of the production of prolapsus uteri by experiment on the amount of force required to pull the os down to the vulva, and to bring it outside the orifice.

Complications. — Before proceeding to consider the symptoms and diagnosis of prolapsus, we must note that the displacement is constantly complicated with morbid changes in the displaced structures.

i. *In the uterus.*—Not only is the uterus, that has descended from its normal level, apt to be displaced backwards, but it is commonly also the subject of a marked degree of hypertrophy. The hypertrophy may chiefly affect the body of the uterus. The organ may have been from the first in the state of subinvolution that so frequently gives a proclivity to displacement; or a chronic congestive metritis may have taken place during the course of its descent. The entire walls are thickened and indurated, and the endometrium is expanded and vascular; until the menopause sets in, a patient with a prolapsed uterus is thus the subject of constant endometritis. In other cases, and more frequently, the inflammatory process is not confined to the body of the uterus; the cervix also is hypertrophied. The resulting elongation of the cervix may be found affecting the supravaginal and intermediate portions, so that the canal is more than double its ordinary length, whilst the anterior lip barely projects beyond the level of the anterior fornix. This state of matters obtains where the mischief has begun with exposure of the anterior vaginal wall from incompetence of the perineum. In other instances we have to do with a hypertrophy of the infravaginal portion of the cervix. The two lips of the os are usually found distinctly separated as a result of fissuring during labour, and both lips may be found thickened and elongated. If one lip be predominantly affected it is likely to be the anterior. This hypertrophy of the cervix is to be carefully distinguished from another variety of elongation of the infravaginal portion of the cervix uteri, which may be congenital in its origin, and in which such an elongation of the infravaginal portion exists, that the external orifice may appear at the vulva or even project beyond it, whilst yet the fundus of the unaltered body of the uterus retains its normal place at the pelvic brim. In the different forms of cervical hypertrophy the lining membrane shares in the growth and vascularity, so that we constantly find a catarrhal endometritis, both cervical and corporeal. The endocervical catarrh is likely to extend through the ectropic orifice, so that we frequently see catarrhal patches on the external surface of the lips; and when the prolapse has existed for some time in a complete form, the eroded surfaces are usually covered with a diphtheroid pellicle. It is noteworthy that the lips of the procident uterus, so subject to simple inflammatory changes, very rarely become the seat of cancerous disease. Now and again an epithelioma is found in the protruded cervix, usually in women well past the menopause; but procidence of the ragged os of a multipara seems to confer on it a certain degree of immunity from malignant degeneration.

ii. *In the vagina.*—Whilst the herniation is still in progress, the vaginal walls are in a catarrhal condition and covered with moisture. When it is complete, the surfaces that have become smoothed and deprived of their rugosities become perfectly dry; and in cases of long-standing eversion, the investing epithelium takes on in places the appearance of the epidermis of the skin. Eroded surfaces are not infrequently found in the neighbourhood of the cervix uteri covered, like those on the cervix, with a greyish shining pellicle. Very rarely ulcerative processes affect it more deeply, or an epitheliomatous degeneration may occur; but these are more likely to result from the action of ill-adjusted pessaries than from the long-continued displacement.

iii. *In the bladder.*—Imperfect evacuations of the distorted bladder are apt to lead eventually to cystitis; and in the diverticulum that pouches through the vaginal orifice below the level of the meatus urinarius concretions occasionally form. I have removed three vesical calculi from such a displaced bladder, complicating prolapsus uteri, which had formed in a woman from a district where stone in the bladder is almost unknown (see Fig. 57, *d*).

iv. *In the rectum.*—The rectum may be the seat of irritation from undue lodgment of fæcal matter where the pouch of the rectocele projects distinctly below the anal aperture. Sometimes prolapsus recti is found in a patient with prolapsus uteri.

v. *In the pelvic peritoneum.*—As the appendages of the uterus follow it in its displacement, so they are likely to share in its inflammatory changes. The most important, however, of the intrapelvic inflammations to be noted in connection with descent of the uterus, is that which affects the pelvic peritoneum. When pelvic peritonitis is set up in this hernial sac it is apt to lead to adhesions of the apposed surfaces of the viscera in their distorted relations, and any attempt at reposition in such circumstances may be attended not only with suffering, but with danger to the patient.

Symptoms.—The symptoms that arise are due partly to the displacement and partly to the attendant changes in the uterus and adjacent organs.

i. *Disturbance of uterine functions.*—The patient may have menorrhagia due to the endometritis. Commonly she has leucorrhœa whilst the descent is in progress, and this discharge lessens or disappears when the prolapsus is complete. Conception may occur, and the displacements may prove troublesome during pregnancy or labour. As a rule the patient's reproductive power is lessened, and she has acquired sterility.

ii. *Disturbance of vesical or rectal functions.*—The patient may have frequent desire for micturition or difficulty in securing complete evacuation of the bladder or the rectum.

iii. *General pelvic disturbance.*—She may have difficulty in walking or in working with a mass protruded between the thighs. Even in the incomplete stages she may have a sense of weight and dragging in the loins or groins. In many cases all that the patient complains of is the presence of the uterus at the vulva or outside of it.

Physical Diagnosis.—When a patient comes to us complaining of a falling of the womb, we may find her diagnosis of her own malady to be correct. Sometimes, instead of prolapsus uteri, we may find another displacement, such as retroversion or even inversion; or we may find that an intra-uterine fibroid has become pediculated, and is in course of extrusion through the canals. The body that has appeared at the vulva may be a mucous polypus from the cervix; or indeed it may be the cervix itself in a condition of hypertrophic elongation. There may be only cystocele or rectocele, without uterine dislocation; or a tumour growing from the vaginal wall may project through the vulva. The supposed fallen womb may even prove to be a swelling in some part of the external pudenda, such as a neoplasm or cystic accumulation, or simple hypertrophy; such was the case of a young lady, in whom the nymphæ were unusually long and dependent, whose mother thought her to be the subject of prolapsus uteri.

Complete prolapse of the uterus is usually very easily recognised on inspection. Hanging from the vulva between the patient's thighs is seen a mass, the size of a fist, pink in hue, or more purple if the tumour be congested, with a smooth surface except when erosive patches are present, and presenting at its lower anterior aspect the external orifice of the uterus. Around the os the labia sometimes form a projection; often it is difficult to trace the line of demarcation between the cervix and the vaginal wall. When the herniated mass is grasped between the fingers and thumb the outline of the entire uterus may sometimes be felt within. In other cases one feels only the elongated supravaginal portion of the cervix, round and hard; and the bimanual examination has to be made to ascertain the position and direction of the body of the uterus. The sound will at once distinguish the os uteri from a fissure in a fibroid tumour that might have descended to the vulva; and carried up through the canal the sound will give fuller information as to the length and direction of the uterus and the condition of its parietes. The sound (or a catheter) should further be used to determine the direction of the urethra and the exact relations of the bladder cavity; and a finger in the rectum adds to our knowledge of the size and place of the uterus, and demonstrates the degree of pouching that has affected the bowel itself.

In cases of incomplete prolapse, when we make inspection and tell the patient to bear down, we can see the unusual mobility of the anterior vaginal wall, and recognise the os as it becomes depressed towards the vulva; and the bimanual examination reveals to us the relations which the uterus has assumed in the lower part of the pelvis. In some cases the displacement, which is complete when the patient is in the upright posture, disappears when she lies on her back. Then the patient can be made to expel the womb by a down-bearing effort; or it can readily be brought down by traction on the anterior lip of the os. We can thus demonstrate, as it were, the mechanism of the herniation. In our examination we have to keep in view not merely the displacement, but also the complications that may attend it; and we may see occurring rapidly the displacement which came about gradually under the combined and protracted action of the various factors. Through the patulous vulva the anterior vaginal wall is exposed; as the patient bears down, or as we make supra-pubic pressure through the abdominal walls, the vesico-vaginal septum is seen to descend until the anterior fornix vaginæ comes through the pudendal aperture, bringing with it the cervix uteri.

First the anterior and then the posterior lip of the os externum appears; and, after the uterus has escaped, the posterior wall of the vagina becomes inverted, and the prolapsus is complete.

Prognosis.—Death in connection with prolapsus uteri may occur in patients with an irreducible prolapse where septic inflammations have been set up extending to the general peritoneal cavity, as in a case recorded by Dr. Barbour Simpson in the *Scottish Medical and Surgical Journal* for March 1905. Such fatality is extremely rare. But, on the other hand, when the uterus has sunk definitely and for some time from its normal level, it has no natural tendency to recover its proper place. Two physiological conditions may modify the course of the mischief.

i. *Influence of pregnancy.*—If the patient become pregnant, and due care be taken to prevent abortion or aggravation of the trouble during the first three months, she is likely to be freed from all the discomforts of prolapse, as the uterus from this time onwards rises out of the pelvis and becomes an abdominal organ. Sometimes, by good management of the labour and the puerperium, the involution of the uterus may be so perfectly secured, and the tonicity of its ligaments so far restored, that at least a partial cure may be attained. On the other hand, it more frequently happens that the displacement recurs—it may be, in an aggravated degree—after the patient gets up.

ii. *Influence of the menopause.*—At the menopause the herniated organs usually undergo the ordinary process of senile atrophy that will lead to a diminution in the size of the swelling and relief from some of the attendant symptoms. The relaxation of the ligaments and loss of the fatty padding of the pelvis incidental to this period of life sometimes, however, allow of further descent of the uterus, so that now the patient applies for relief for the first time; and it must never be forgotten, in the cases where pessaries have been long worn in the vagina, that the shrinkage and loss of vitality in the walls may lead to ulcerative processes to which the tissues had shown no previous tendency.

Treatment.—A prudent practitioner in his midwifery practice will keep in mind the risks to which a woman is subject who comes out of her confinement with a damaged perineum, relaxed uterine ligaments, and subinvolution of the uterus. He will note during labour the conditions that endanger the perineum and seek to avert its laceration. Where laceration has occurred he will see to its immediate repair, bringing together the raw surfaces with sutures at the close of the third stage, or within twelve hours thereafter. He will guide the convalescence, and see that no undue exertions are allowed until the ligaments have recovered their tone, and the uterus is restored to its non-gravid dimensions. By such prophylactic measures he saves his patient from the beginnings of a displacement which may cause little disturbance at first, but which will go on to increased distress, and may be a source of trouble for a lifetime.

Where the prolapsus uteri is complete, the indication for treatment is twofold—to reduce, and to retain the displaced organ.

i. *Reduction of the uterus.*—The uterus, which is completely prolapsed when the patient is in the upright position, is often reduced of itself when she lies down, so far, at any rate, as to disappear within the vaginal orifice; or when not spontaneously replaced it may be made to return with the gentlest amount of pressure. Occasionally some degree of force must be exerted; and in performing taxis in such cases the practitioner has to keep in mind the manner in which the herniation occurred, and to seek to replace the structures in the reverse order to that in which they descended. He begins with the posterior wall of the vagina, which was the last to escape, and presses it past the perineum. The uterus follows, first the posterior and then the anterior lip of the cervix. Last of all, the anterior vaginal wall is replaced. It is especially in such cases that the anterior wall is found to have become greatly thickened, widened, and indurated in its texture. In some instances the prolapsed mass is so swollen and congested that the patient must be kept at rest for some days before the reduction can be safely effected; and during that time she may use a hot sitz bath, or have a stream of hot water made to play over the tissues two or three times a day, so as to reduce the hyperæmia. It may even be necessary, for this purpose, to make some scarifications on the surface to relieve the vascular tension. Where an active peritonitis is present, or peritonitic adhesions have formed among the displaced viscera, rude or rapid manipulation would be attended with danger; and prolonged antiphlogistic measures should be employed before the attempt is made to replace the organs. In all cases the reposition should not only be preceded, but also followed by the adoption of an antiphlogistic treatment calculated to lessen the uterine hypertrophy, and of measures calculated to restore the tone of the pelvic tissues. With this view it may be necessary to curette the uterus, and to apply iodine and carbolic acid to the interior; to administer ergot and quinine, or such deobstruents as the iodide and bromide of potassium; to use such waters as those of Kreuznach, Krankenheil, Ems, or Kissingen, and to enjoin the use of hot astringent douches.

Massage has been employed for the relief of this as of other pelvic mischiefs; and Thure Brandt, who by his successful treatment of various uterine disorders has induced some members of the profession to adopt the practice in recent years, has suggested a mode of reduction of the prolapsed uterus which has been followed by various gynæcologists in different countries with encouraging results. The patient under treatment is placed on her back with her knees bent up; and, while an assistant pushes up the pelvic organs through the vagina, the operator lays hold of the body of the uterus with the finger-tips of his two hands pressed through the abdominal walls at the pelvic brim. When he feels that he has the uterus between his hands, with a kind of wriggling movement he pulls it upwards as far as possible into the abdominal cavity. This uplifting of the organ has to be repeated daily, or at short intervals; and the congestive processes are at the same time relieved by friction applied to the uterus and its adnexa through the abdominal parietes. But, besides acting thus on the uterus and appendages, the operator, placing himself at the foot of the couch, tells the patient to keep her knees as tight together as possible, whilst he forcibly abducts the thighs; and again he tells her to try to keep the knees apart whilst he forcibly brings them together. The effect of this alternate action of her adductor and abductor muscles is to increase the vigour of the muscular structures within the pelvis. This is further favoured by stimulation of the lumbar muscles, and gymnastic exercises calculated to develop the patient's muscularity, but these are not essential to the cure of the prolapsus. Those who have succeeded in this "kinesitherapeutic practice," as it has been called, have expressed the conviction that it will lessen the frequency of surgical operations; but it is admitted that the method is not quickly learnt, and that its application requires long fingers, a supple hand, muscular activity and dexterity, and inexhaustible patience.

ii. *Retention after replacement.*—The reduction of the prolapsed uterus is usually easy of accomplishment; it is far otherwise with its retention in place. The attempt to fulfil this indication may be made either by the application of some kind of support, or by the employment of some operative procedure. The former line of treatment is for the most part merely palliative; the latter aims at a more radical cure.

(*a*) *Palliative measures.*—Among the means we have been employing to reduce the inflammatory conditions in the pelvis an important place will have been given to the use of pledgets of cotton soaked in glycerine. For deobstruent purposes the glycerine will have been medicated with ichthyol; where a more astringent action is desired, an astringent like tannin will have taken the place of the ichthyol. These pledgets of cotton may so fill up the vaginal cavity as to have at the same time the effect of supports to keep the uterus in place. Or the vagina may be packed tensely with iodoform gauze or salicylated cotton wool; when the packing has again the double function of keeping up the uterus and promoting absorption of inflammatory deposits. Such vaginal tampons require to be changed every two, three, or four days. Patients can wear a tampon of marine lint for a week without any discomfort; but a woman cannot be expected to go on for any length of time using vaginal tampons that may require the assistance of the medical attendant for their proper application. Accordingly, when these have fulfiled their function in lessening the pelvic congestion, and have demonstrated that a foreign body can be retained in the vagina which prevents the recurrence of the prolapse, the practitioner has to consider what kind of vaginal pessary will be likely to keep the patient comfortable. Now the variety of vaginal pessaries is endless. There are differences in—

(*a*) The material of vaginal pessaries.—They are sometimes made of metal. Of these the most practical are the rings made of some flexible material that allows of changes in their form to suit individual cases. Pessaries of wood were at one time in frequent use; and they have been made also of ivory, bone, and of soft materials covered with some impervious substance. These have now been almost entirely replaced by india-rubber, either in its soft state or in the hard state of vulcanite. The soft rubber pessaries have the advantage of easy application to a wide range of cases; the drawback to their continuous employment is their tendency to lose elasticity when they lie for a length of time in the vagina; at the same time they absorb secretions and become the source of disagreeable discharges. The pessaries of vulcanite can be worn for long periods without undergoing any change or becoming the source of any trouble if care be taken to see that they are properly adapted. They can be modified in form by being placed for a minute in boiling water; but they are apt to break when attempts are made thus to change their curves: hence it is necessary for the gynæcologist to have a set of vulcanite pessaries of different sizes and outlines always at hand. If he can procure pure gutta-percha he has at his command a material out of which he can fashion a pessary for any given case. In boiling water gutta-percha becomes so soft that a piece of the proper size can be rolled between the palms of the hands till it has the form of a smooth round ball; and further manipulation can then mould it into the form of a disc and stem, of a hollow perforated disc, or of a simple ring or horse-collar, according to the requirements of the case. Patients have sometimes worn gutta-percha pessaries for years with comfort. But, as the material is somewhat porous, it is better for the practitioner, when he has found the form and size that suit his patient, to send the gutta-percha instrument to the manufacturer in order to have one of the same pattern modelled in vulcanite. The only material that can compete with vulcanite in lightness, smoothness, and freedom from irritation in the vagina is celluloid.

(β) The shape of vaginal pessaries.—Globular or egg-shaped pessaries, hollow and made of vulcanite, are very serviceable where the perineum has still some retentive power, and the patient suffers from a tendency to descent of the vaginal walls and the uterus; especially in elderly women. In many cases the ring pessary gives satisfactory results. The soft india-rubber ring is easily introduced and adapted to the vaginal cavity. It should be carried up so as to lie in the vaginal roof, the posterior being higher than the anterior border, and should find its support on the upper surface of the plane of the levator ani. Where there is a marked degree of cystocele the ring should be filled with a perforated diaphragm, which serves better to retain the anterior vaginal wall in position. The soft pessary, however, should not be left for prolonged wear; but if the ring give comfort it should be replaced by one of vulcanite or celluloid. Instead of a simple ring, a pessary that is discoid or saucer-shaped will often better retain the structures in position. Such a pessary holds all the better if the posterior border be made thicker than the anterior; and it may be worn for many months without any discomfort. A series of perforations allows of the free escape of the menstrual discharge, and also of the washing out of the vaginal cavity with the douche. Where the ring or the saucer-shaped pessary fails to keep in place, the herniation can sometimes be prevented by making the patient wear a disc and stem pessary; the stem projecting from the lower surface of the disc lies between the labia. The disc may be circular, but is better elongated from side to side so as to keep the walls of the vagina extended transversely. The patient learns easily to introduce such a pessary as she lies on her back, by passing in first the one side through the vaginal orifice and then the other, as a button is passed edgewise through a buttonhole. She removes it from time to time when going to bed by laying hold of the stem with the finger and thumb of one hand, while the forefinger of the other hand lays hold of one edge of the disc and presses it out. She can thus secure the cleanliness of the instrument, and, if need be, she can douche the vaginal cavity in the interval of removal. The Zwanck and other pessaries with hinges and screws are all unsatisfactory.

When the ball, the ring, or the discoid pessary fails in consequence of extensive lacerations of the perineum, or relaxation in the muscular planes of the pelvis, the patient may still obtain some relief from her displacement by wearing an abdominal bandage in addition to the pessary. A perineal strap passing between the patient's thighs will keep the pessary in place; or it may be fixed to the bandage by a curved metallic rod, or by elastic bands. But, as in the case of patients with an inguinal hernia where a truss does not give relief, the surgeon proposes to the patient an operation for the radical cure; so here, when there is a multiplicity of arrangements required for the relief of the pelvic hernia, the gynæcologist will suggest that it is better to have recourse to some operative procedure likely to effect a cure of her condition.

(*b*) *Operative measures.*—There are four different directions in which he may proceed to effect his purpose of securing the uterus in its proper place, and he is guided in his choice partly by the primary fault which initiated the displacement, and partly by the changes which have ensued in the dislocated structures. He may seek (*a*) to lessen the pudendal aperture by one or other of the operations of episiorraphy or perineorraphy, which have for their object not merely narrowing of the aperture, but restoration of strength to the pelvic floor. Or he may (β) narrow the vaginal canal by an anterior or posterior colporraphy. In certain cases he finds it necessary (γ) to diminish the size of the uterus by amputation of one or both lips, or by removal further of the enlarged supravaginal portion. He may even have recourse to vaginal hysterectomy. (δ) The prolapsed uterus has sometimes been dealt with by shortening of the round ligaments either according to the Alexander-Adams procedure in the inguinal canals or intra-peritoneally, and where the child-bearing period has passed excellent results have been obtained by bringing about new attachments of the uterus to the abdominal walls by ventro-fixation or hysteropexia. In some cases a single operation suffices to remedy the mischief; in others two or more of the operations must be carried out in the same individual, and usually it is best to perform them all at once rather than at intervals (*vide* article "Plastic Gynæcological Operations," pp. 823-830).

B. Deviations in Position

The uterus may be placed unusually far (i.) backwards, in a state of retro-position; (ii.) forwards, in a state of antero-position; or (iii.) to one or other side—right or left—lateri-position. These displacements of the uterus may be due, on the one hand, to tumours, inflammatory effusions, or hæmorrhagic extravasations pushing the organ out of its place; or, on the other, to peritonitic adhesions or cellulitic contractions pulling it out of its place. For example, a cellulitic swelling in the left broad ligament in its early acute stage will thrust the uterus towards the right side of the pelvis; and if the inflammatory process end, as it sometimes does, in producing an atrophy of the ligament, the uterus will eventually be dragged towards the left side. So, in the acute stage, a peritonitic effusion in the pouch of Douglas will press forward the uterus which at a later period, if the parts become fixed by inflammatory adhesions, will be retroposed. It is obvious that these malpositions of the uterus do not constitute the central phenomenon in any individual case; still it is important to keep them in mind, because they are often found complicating some of the other displacements, and obscuring the diagnosis.

They can usually be recognised by means of the bimanual examination, supplemented, if need be, by the use of the sound or volsella: their treatment falls under the treatment either of the causes that produce them, or of the displacements with which they co-exist.

C. Deviations in Direction

The uterus is subject to changes in the direction of the fundus, which may be displaced backwards, forwards, or to one or the other side (see Fig. 58). In either case there are two different conditions of the

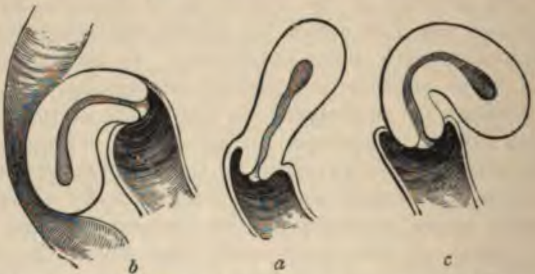

FIG. 58.—*a*, Normal direction of uterus when bladder is partially distended; *b*, retroflexed uterus; *c*, anteflexion.

uterus itself to be observed. In one, the whole uterus is more or less rotated on its axis, the body and the neck of the uterus form a straight line; the uterus is in a state of version, and we have retroversion, anteversion, or lateriversion. In the other case the body has mainly or alone undergone the change; the body is bent on the neck, the uterus is in a state of flexion, and we have to do with retroflexion, anteflexion, or lateriflexion. The most important, from the practitioner's point of view, are the—

I. Posterior Deviations.—These have sometimes been described under the convenient designation of retrorsions—a term which includes the cases where the entire uterus is displaced, the retroversions, and those where the body chiefly is displaced and bent on the cervix—the retroflexions. In a simple retroversion the uterus has lost its tendency to fall forward towards the symphysis pubis; the organ is to some degree stiffened so that the cavity of the body and canal of the cervix form a continuous line; and it has become rotated on its axis so that the fundus remains permanently directed towards the sacrum, and the os, instead of looking backwards, is directed downwards or forwards according to the degree of version that has been established (see Fig. 59, *a*). The varying degrees of retroversion in individual cases should be estimated by noting whether the fundus is directed towards the promontory of the sacrum, or towards the first or a lower sacral vertebra. In a case of retroflexion the uterus has not only lost the normal anterior inclination, but the body has also become permanently bent backwards (see Fig. 59, *b*). The os may still look backwards; but as in most cases of retroflexion there is some degree of retroversion present, the os will come to change its direction also: thus in well-marked cases the fundus is found lying in the lowest part of the pouch of Douglas below the level of the os, which looks towards the lower margin of the pubic symphysis (see Fig 58, *b*).

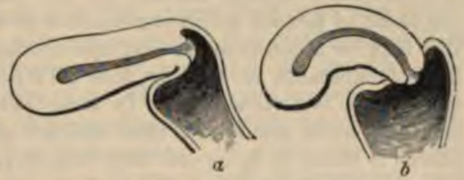

Fig. 59.—*a*, Retroversion, *b*, retroflexion, of the uterus.

Causes of Retrorsions.—Before studying causes on the part of the uterus itself, on the part of its ligaments, or on the part of the influences that tend to bring about these changes in the direction of the uterus, we may note that some cases are—

i. *Congenital.*—On post-mortem examination of infants and young children the uterus is sometimes found retroverted or retroflexed to a degree not to be accounted for by the dorsal decubitus of the body. In young married women the displacement may be present when there is no antecedent history to lead us to suppose that the ordinary operative causes have been at work. I have more than once met with retroflexed uterus in married women who were sisters. I have even had under my care two sisters, one married and the other single, who were both suffering from retroflexion; and the displacement reappeared in the two daughters of the married one. This congenital displacement is sometimes associated with elongation of the cervix or with shortening of the vagina, notably of the anterior wall; but it may also occur without any concomitant deformity.

ii. *Changes in the uterus.*—Whatever causes tend to produce (*a*) induration of the uterine tissues, and so to destroy its normal flexibility, tend to bring about a version of the organ. Subinvolution, chronic metritis, and tumours in the walls, which make the organ rigid and unable readily to accommodate itself to the distensions and evacuations of the neighbouring organs, especially of the bladder, render it liable to be affected by the influences that press the fundus backwards, and so to suffer retroversion. Hence the frequency of this displacement in women who have given birth to one or more children, and have subsequently remained sterile; for these chronic inflammatory changes in the uterus are very apt to arise in connection with puerperal processes, whether they begin in the placental site, as suggested by the elder Martin, or in other parts of the uterine parietes. When the anterior wall is chiefly affected, a retroversion will result; and this the more certainly the lower down in the wall the thickening is situated. (*b*) Of relaxation of uterine structure retroflexion is more likely to be the consequence. In cases of persistent retroflexion a notable atrophy of the posterior wall is usually found at the point of flexure which corresponds to the isthmus. In some instances this may be a consequence and not a cause of the flexion; but in others, loss of substance as well as loss of tone precedes the displacement and favours its occurrence; and in some patients, where both anterior and posterior walls are found thus thinned and relaxed at the isthmus, the uterus is liable to be at one time retroflexed and at another in a state of exaggerated anteflexion.

iii. *Changes in the ligaments.*—It is in the loss of retentive power of some of its ligaments that we most frequently find the explanation of a retroversion. When (*a*) the utero-sacral ligaments are relaxed, the cervix is liable to be carried too far forward, and then the fundus is likely to fall backwards; (*b*) the retroversion is favoured when the round ligaments are relaxed, and fail in their function of keeping the fundus directed towards the abdominal wall; but whilst loss of tone in the utero-sacral and round ligaments is the most important element in the production of retroversion, we note (*c*) that the changes in these ligaments are frequently conjoined with relaxation of the broad ligaments and of the structures in the floor of the pelvis. We have seen, in dealing with prolapsus uteri, how influential are these conditions in leading to descents of the organ; and we then noted that descent is apt to be attended with retroversion and retroflexion. There is, however, another ligamentous change which may be chargeable with the production of a backward deviation of the uterus. This occurs when (*d*) the utero-vesical ligaments are shortened as a result of chronic inflammation. The tense structures dragging the isthmus forwards, or keeping it somewhat immobile, prevent the uterus as a whole from making the excursions in various directions demanded by its relations to the neighbouring organs. The body remaining more mobile than the cervix, and retaining its normal flexibility, is apt to be turned back into the hollow of the sacrum, and a retroflexion is thus established.

iv. *Directly displacing influences.*—Of the influences that tend immediately to produce retro-deviations of the uterus we may note—(*a*) A strain or fall or other jar to the body which has sometimes preceded the appearance of symptoms associated with a retroversion or retroflexion of the uterus. In some such cases the pre-existing displacement may not have been recognised; in others it is easily conceivable that a displacement could be thus brought about, especially if at the time of the accident the fundus were lifted backwards by a distended bladder. (*b*) Frequent over-distension of the bladder, which will keep the fundus uteri directed to the promontory of the sacrum or beyond it. A patient in whom the uterus is frequently in this situation will readily acquire a permanent retroflexion; and this all the more if the bowels have a tendency to constipation and require straining efforts for their evacuation. (*c*) A permanent backward fixation of the uterus which, in some cases, is a result of peritonitis leading to adhesions that bind the posterior surface of the uterus to the rectum and back wall of the pelvis.

Complications.—When tumours of the uterus itself or of the neighbouring organs are associated with retroversion, the displacement is of minor moment, and it usually disappears on removal of the growth. The most important complications depend on the tendency to inflammatory changes in the uterus. These inflammations are sometimes the cause, sometimes the consequence of the displacement; in either case the displacement and inflammation tend to perpetuate and to aggravate each other. The inflammatory mischief may be found in the perimetrium, leading to fixation of the uterus in the pouch of Douglas; or it may affect the myometrium, producing a rigidity that especially perpetuates the retroversions. Most frequently the endometrium is affected; and there is a chronic catarrhal process in the cavity of the uterus, which is likely to spread along the cervical canal and to pass out on the posterior lip in the form of an extensive granulating catarrhal patch. Among the most troublesome cases are those in which the retroversion is complicated with prolapse of the ovaries, because these glands are usually congested and tender when they become thus displaced, and may cause trouble in the adjustment of pessaries which, in other cases, would serve to retain the uterus in position and relieve the patient of her suffering. Moreover, it has often been found on section that retroversions of the uterus have so far interfered with the function of the ureters as to have produced some degree of hydronephrosis. This rarely attracts attention during life; but it is noteworthy that a considerable proportion of women who are the subjects of movable kidney have at the same time some uterine displacement, most frequently in the form of retroversion or retroflexion.

The Symptoms of retrorsions of the uterus are due partly to the displacement, and partly to the inflammatory changes that so frequently accompany or flow from it. They consist of—

i. *Disturbance of uterine functions.*—This disturbance may affect either the menstrual or reproductive functions, and in many cases both of these functions are disordered.

(*a*) Menstrual disorders.—While an amenorrhœic patient may have a retroflexed uterus, as in some cases of superinvolution or in some cases of hydrometra or hæmatometra, patients who are the subject of retroversion or retroflexion usually suffer from increase of the menstrual flow; in many instances, indeed, it is because of the menorrhagia that they seek advice. The excessive flow, however, is symptomatic of the attendant endometritis rather than of the mere displacement. Sometimes dysmenorrhœa running throughout each menstrual period is a leading symptom; and whilst in some cases this also finds its explanation in the inflammatory condition of the uterus, in others it is associated with the displacement; especially in cases where the uterus is so retroflexed as to have lost its erectile power, and where mechanical straightening of the organ relieves the menstrual pain. Intermenstrual discharges, again, presenting any of the characters of leucorrhœa, are most frequently due to catarrhal processes in the cervix or body of the uterus.

(*b*) Reproductive disorders.—If retroflexion be found in a patient who complains of dyspareunia, the explanation of the suffering will usually be found in some of the complications that are present—such as vaginismus or oophoritis—unless the displaced organ be itself the seat of an active inflammation. Sterility, on the other hand, is often the result of retroflexion, and thus a leading symptom of it. This may be the case in women who have never conceived. I have treated, for instance, two sisters in each of whom, after two or three years of childless marriage, the uterus was found retroflexed; in both of them conception occurred after the uterus had been replaced with the sound and kept in place with a vaginal pessary. Still more constantly one finds the uterus turned back in the case of women who have given birth to one or more children and then cease to conceive. There are others, again, in whom conception occurs from time to time, but who bear no more children because, with a retroverted uterus, they become the subjects of habitual abortion.

ii. *Disturbance of neighbouring organs.*—We have seen how much the position of the uterus is modified by the changing relations of the adjacent viscera. When it loses its power of adaptation to these organs, and is persistently displaced, it may prove a source of irritation to them. Hence we have—

(*a*) Interference with the rectum.—The patient sometimes suffers from mucous dejections and frequent desire for defæcation; more frequently there is obstruction to the easy escape of the intestinal contents, and the bowels are emptied with severe straining efforts.

(*b*) Interference with the bladder.—The bladder may be unaffected; but the patient who has a retroverted uterus is liable to suffer from frequent calls to micturition, or difficulty in evacuation of the bladder, especially if the uterus be at the same time enlarged. A patient who has not menstruated for two or three months and suffers from retention of urine is almost sure to have retroversion of the gravid uterus.

(*c*) Interference with pelvic muscles and nerves.—Patients with retroversion or retroflexion of the uterus sometimes seek advice because of pain referred to the pelvic cavity, to the sacrum, or to the lower extremities. In some the suffering is aggravated by any kind of exertion; in others, where there is no pain, there is loss of power in the lower extremities, so that the patient appears paraplegic, and is only able to walk when the uterus has been righted and retained in its proper place.

(*d*) General constitutional disturbance.—Besides the more localised symptoms we may find the patients complaining of derangements of more distant organs, such as the reflex neuralgias, gastric distress, mammary irritation, and general depression that are so often associated with other forms of uterine trouble.

The Diagnosis, however, of a retroversion or retroflexion of the uterus cannot be founded merely on these functional symptoms. It can only be made out by direct physical examination.

i. *Abdominal palpation* gives negative results.

ii. *Vaginal exploration.*—The finger introduced into the vagina finds the os looking downwards or even directly forward; the anterior fornix empty; and the posterior fornix occupied by a rounded resistant body, which, if a second finger be introduced, is felt to be continuous with the cervix and to move in concert with it. To acquire certainty as to the condition our great reliance is placed on—

iii. *Bimanual examination.*—The fingers of the left hand applied to the hypogastric region press down the uterus and its adnexa so deeply into the pelvis that the index and medius of the right hand, by which the vaginal exploration is made, get more fully into contact with all the pelvic viscera. The forefinger being placed on the cervix uteri and the middle finger in the posterior fornix vaginæ, the exact relations of the uterus in most instances can be distinctly defined (see Fig. 60). If it be retroverted, the body is found running directly backwards whilst the os looks forward; and if there be retroflexion, the angle at which the body is bent on the cervix can be felt. In this manner, after a little experience, the practitioner succeeds in diagnosing the condition with the greatest certainty. Occasionally, greater certainty is attained by introducing the medius into the rectum whilst the index explores by the vagina.

iv. *Use of the sound.*—As gynæcologists first learned to appreciate the frequency of retroflexions of the uterus by the use of the sound before the bimanual method had been fully developed, so the young practitioner will often find it useful to satisfy himself of the direction of the body of the uterus by passing the sound in a case where his bimanual exploration still leaves him in doubt. There are even cases where the most experienced gynæcologist is glad to avail himself of its services; especially if the displacement be associated with tumours or with hæmorrhagic or inflammatory effusions. There are cases where the bimanual examination is impeded by the thickness of the abdominal walls, or painful because of their tenderness; the pasage of the sound then speedily and painlessly clears up the diagnosis.

v. *Other aids to diagnosis.*—The volsella may sometimes be used to pull upon the cervix, or the speculum may be introduced to determine the condition of the lips of the os uteri. For determination of the displacement in itself they are unnecessary. But to get the full benefit of bimanual examination it is often necessary to bring the patient under an anæsthetic. This becomes the more necessary where any tumours or adhesions are likely to interfere with the easy reposition of the organ; indeed, it may be dangerous to the patient to undertake the treatment of a case when these are overlooked.

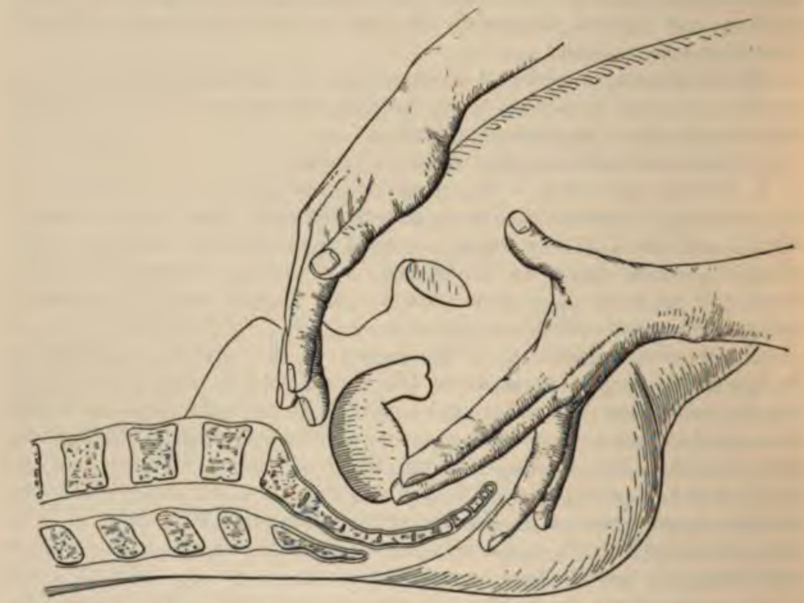

FIG. 60.—First stage in bimanual reposition of the uterus according to Schultze. Fingers of the left hand are represented as applied to the uterus in the vaginal roof; those of the right touching it through the abdominal wall. In this country the relation of the left and right hands is reversed.

Prognosis.—"Ils ne tuent pas, mais ils ne guérissent pas," said Velpeau in one of the discussions in the French Academy of Medicine, when some of his confrères who were averse to the employment of pessaries argued that displacements of the uterus were not dangerous to life. Retroversion or retroflexion of the uterus is assuredly not a condition likely to prove fatal, but it may be a source of life-long discomfort. The only conditions under which a patient with this displacement may get rid of her trouble would be (i.) in the rare cases where, having escaped the danger of abortion, she has carried a child to the full term, and a normal involution of the uterus and its ligaments has been secured during the puerperium; or (ii.) when the uterus undergoes such atrophy as sets in at the menopause.

Treatment.—When a retroversion or retroflexion of the uterus is found in a patient who comes complaining of the symptoms described in the preceding paragraphs, the practitioner, before proceeding to deal with the displacement, must make sure that it is an uncomplicated case. In a very great proportion of instances the first indication he has to fulfil is—

i. *To combat the complications.*—Among these the inflammations in and around the uterus hold a foremost place. It is sometimes difficult to determine whether the patient's distress be more due to the inflammation than to the displacement; and it often enough happens that under antiphlogistic measures the walls of a rigidly retroverted uterus become softened, or the flaccid walls of a retroflexed uterus recover their tonicity and the organ rights itself. So perimetritic adhesions may become relaxed, cicatricial indurations of the utero-vesical ligaments may disappear, or tension be restored to utero-sacral ligaments that had lost their contractility; spontaneous reposition of the displaced viscus may thus come about. When, after inflammatory conditions have been removed, the uterus retains its abnormal place, the inflammatory changes will all recur unless the uterus be replaced. There are many cases, moreover, where reposition of the uterus, without special antiphlogistic treatment, is followed by removal of the congestive and catarrhal symptoms. The next indication, accordingly, is to—

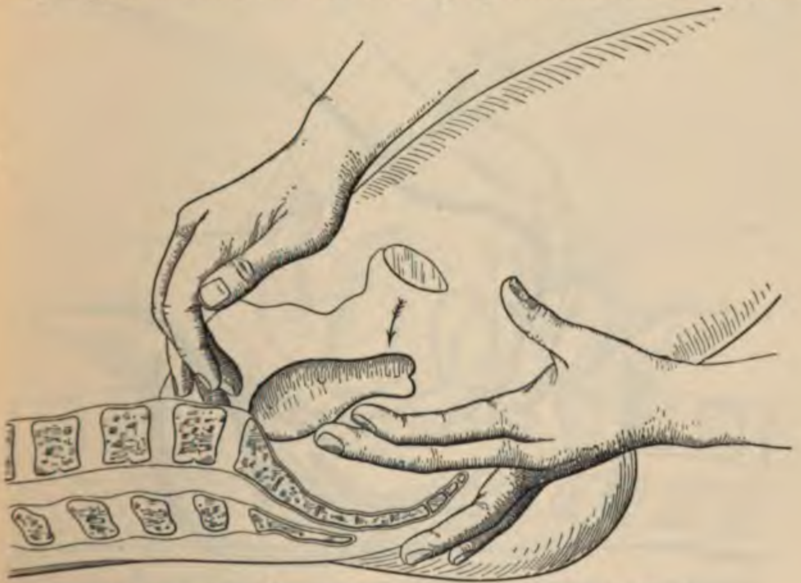

FIG. 61.—Second stage in reposition of the retroflexed uterus. (Schultze.)

ii. *Replace the uterus.*—Various methods have been adopted for securing the reposition of the retrorted uterus.

(*a*) Posturing the patient.—When the patient is placed in the knee-elbow posture, and the perineum is pulled back, so as to allow the vagina to be filled with air, the vaginal roof, carrying with it the uterus, can be seen and felt to have fallen away downwards and forwards. This posturing of the patient and manipulation of the parts have sometimes been used for the purpose of replacing the retroverted uterus. The manœuvre has been specially commended under the idea that the patient by adopting it might succeed in freeing herself of the displacement. But whilst in a few cases of retroversion the uterus might by this means fall into its normal position, in the great majority it will fail to do so. In them, and in all cases of retroflexion, when the patient is put in the genu-pectoral position and the perineum held back, it becomes necessary to pull the cervix downwards and outwards with a volsella grasping the anterior lip of the os, while the fundus is pushed into its proper place either through the posterior fornix vaginæ or through the rectum.

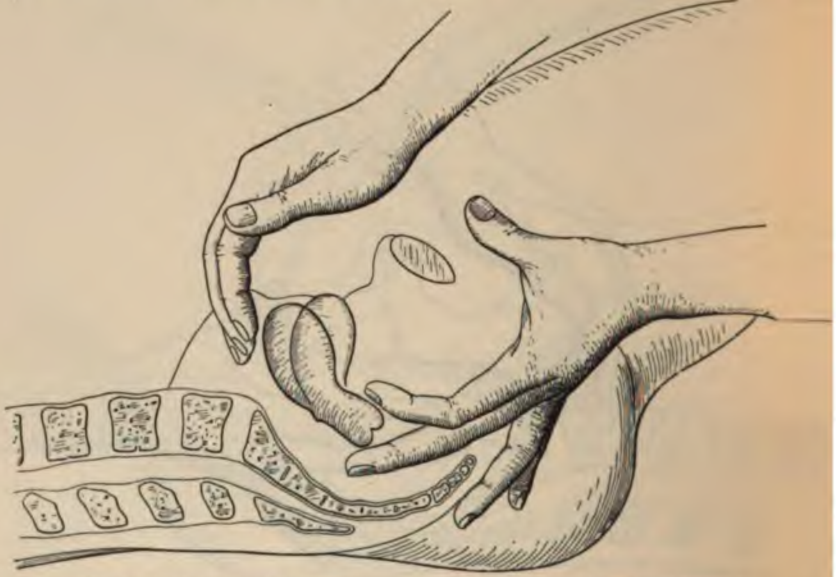

FIG. 62.—Further stages in the bimanual reposition of the retroflexed uterus. (Schultze.)

(*b*) Bimanual reposition.—When a patient has been chloroformed for the purpose of careful diagnosis the best method of reposition is by the bimanual procedure. The fingers of the one hand are pressed through the abdominal walls towards the hollow of the sacrum; and, while the middle finger of the other hand pushes the fundus upwards to bring it within reach of the abdominal fingers, the forefinger is used to push the cervix backwards until, under the concerted action of the two hands, the fundus is carried right forward to the symphysis pubis (see Figs. 61, 62, 63). Occasionally the fundus can be pushed up better by the medius inserted into the rectum. Even when the patient is not anæsthetised, this manipulation can in many cases be carried out without much difficulty, especially where the abdominal walls are thin and flaccid.

(*c*) Reposition with the sound.—When the practitioner is satisfied that he has to do with a uterus that is not bound down by adhesions, his simplest and speediest method of reposition is by means of the uterine sound. It can be effected with perfect safety if the operator be careful to move the handle through a wide area, as the point of the sound turns within the uterine cavity (see Fig. 64); and in this, as in other methods of reposition, it is necessary to carry the fundus uteri far forward till it comes to lie close to the symphysis.

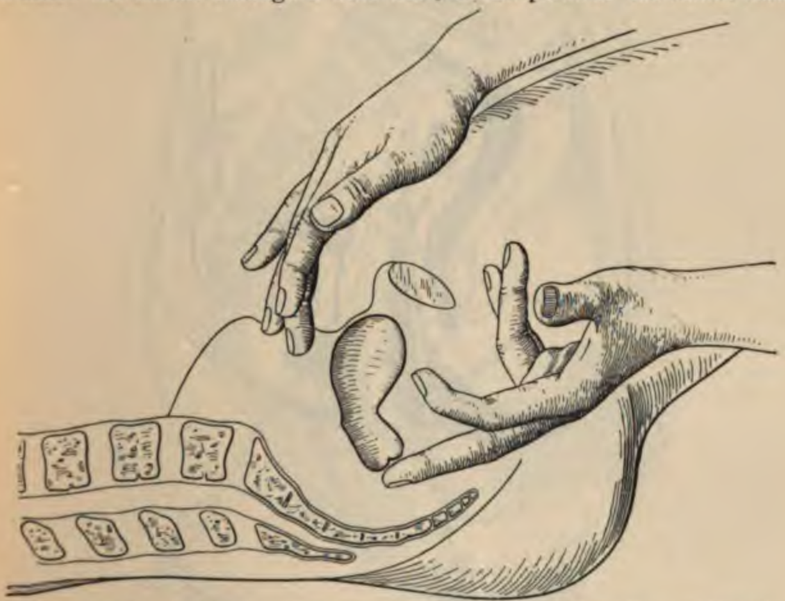

Fig. 63.—Last stage in bimanual reposition of retroflexed uterus: the fundus is pressed towards the symphysis. (Schultze.)

In a few cases it suffices thus to replace the uterus, and to place a pledget of cotton and glycerine in the anterior fornix, when the organ maintains its proper set. Usually, however, it returns sooner or later to its abnormal position; and in many cases the retrorsion is reproduced almost immediately on the withdrawal of the sound or of the replacing fingers. The next indication to be fulfilled, therefore, is the—

iii. *Maintenance in place.*—For this the application of a vaginal pessary in the form of a simple ring will sometimes suffice. Better still is the introduction of a Hodge pessary (Fig. 65), or Albert Smith's very widely serviceable modification of the Hodge pessary. In some cases this pessary is borne with more comfort if the upper bar be thickened, as in the pessaries of Gaillard Thomas and Prochownick. Where the utero-sacral ligaments are greatly relaxed, Schultze's figure-of-eight pessary, or his sleigh pessary, may become necessary.

When we have to deal with retroflexions, the vaginal pessary may be insufficient to retain the uterus in its place, and benefit is to be obtained by the cautious introduction of an intra-uterine stem. The Amann intra-uterine vulcanite stem, fixed on the edge of a disc, does good service in keeping the uterus straight; and when the anterior fornix is packed with iodoform gauze, or with pledgets of cotton or glycerine, the uterus is retained in position, and the walls recover their tone; when three or four periods have passed, the organ may keep its place, or be kept in it, by the use of a vaginal pessary. Instead of a rigid stem of vulcanite a soft india-rubber stem pessary, which is more easily retained, may be passed into the uterus. The intra-uterine pessary sometimes has to be supported and supplemented by the use of the vaginal pessary; but care should be taken not to fix the two pessaries together in any such fashion as to interfere with the movements which the uterus must necessarily undergo in the changing relations of the pelvic viscera.

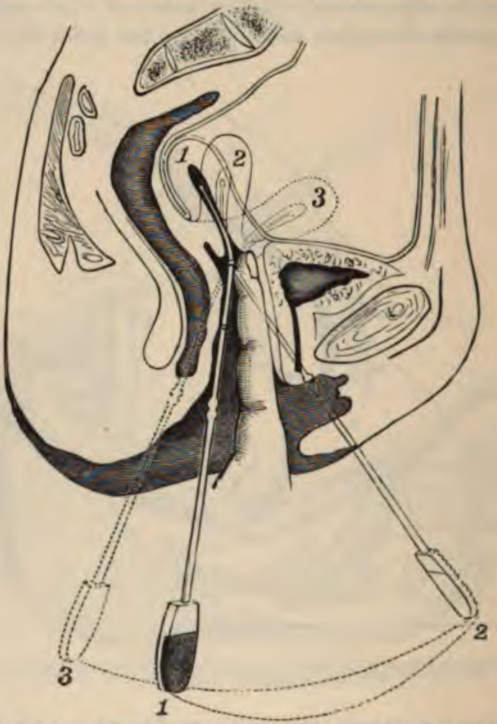

FIG. 64.—Reposition of the retroverted uterus with the sound.

Where patients continue to suffer from the effects of retroversion or roflexion of the uterus unrelieved by mechanical appliances and antiogistic remedies, we must consider whether by some operative erference a cure may be effected. It has been proposed to fix the vix uteri to the back wall of the vagina, but experiments made in s direction have not been encouraging. Better results have been ained from shortening of the round ligaments. Where the uterus

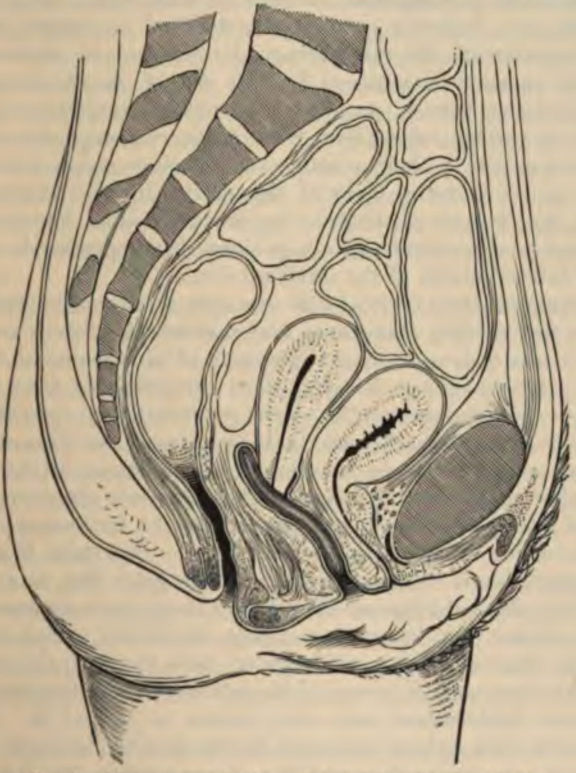

Fig. 65.—Hodge pessary in the vagina retaining the uterus *in situ*.

s acquired adhesions that cannot be relaxed or severed by bimanual nipulations, the operation of laparotomy, which will allow of the eing of the uterus and its subsequent ventrofixation, becomes justible. Several operators have reported satisfactory results from a potomy which allows of the fundus uteri being reached through anterior fornix and fixed anteriorly. The peritoneal cavity has n been opened into by the sacral method; and after the uterus has n freed from adhesions, the fundus has been carried forwards, and the uch of Douglas obliterated so as to prevent relapse of the displacement. ch procedures, however, should be reserved for cases where the retrorsion of the uterus is complicated with some other condition, such as displacement or disease of the ovaries, which aggravates the patient's distress, and forbids the relief that can ordinarily be afforded by properly adjusted pessaries. Some time must elapse before their ultimate results and their relative values can be ascertained, and no conscientious practitioner would subject a patient to an operation extending to the peritoneal cavity without explaining to her the dangers to which she will be exposed. The growing sense of security with which the gynæcologist has recourse to a cœliotomy, whether abdominal or vaginal, leads with growing frequency to the intraperitoneal treatment of uterine displacements. The security is attained by the use of aseptic measures and careful technic, so that in women above forty intraperitoneal fixations can usually be carried out without risk of future complications. In the case of women still in their possible reproductive career, care must be taken not to involve the body of the uterus in any fixation process, because of the dangers of abortion or of complicated labours resulting from damage to the organ on whose integrity depends the successful incubation and expulsion of the fertilised ovum.

II. ANTERIOR DEVIATIONS.—At one time many of the cases of dysmenorrhœa and sterility that came under observation were supposed to be cases of anteversion, or more frequently of anteflexion of the uterus, and were maltreated as such. But since gynæcologists have recognised that, with the bladder empty, the uterus is normally in a position of combined anteversion and anteflexion, they have been less disposed to look to these antrorsions for an explanation of the sufferings of their patients. Some would even eliminate the anterior displacements altogether from the category of uterine disorders, and only admit the existence of a pathological anteversion or anteflexion when they can lay their finger on the condition that causes or keeps up the dislocation. But, however freely we admit that the sufferings associated with these displacements are traceable to the causes that bring them about, or to the complications that attend them, there remains a residuum of cases in which the practitioner finds that he cannot effect a cure of his patient's condition without having regard to the displacement, and using means to correct it. As in the posterior deviations, so here the entire uterus may be rigid and rotated on its transverse axis, giving the condition of anteversion; or the body may be bent more or less acutely on the cervix in the state of anteflexion (see Fig. 58, *c*).

Causes and Complications of Antrorsions.—i. *Congenital.*—In early life the normal anteflexion of the uterus is very pronounced, and it is at the period of puberty that the body of the organ develops more decidedly, and tends to become more erect; then the congestion of each menstrual epoch is attended with a distinct straightening of the utero-cervical canal. In some patients, however, such erection of the organ fails to occur; and though for a time menstruation may go on painlessly, it is apt, in the course of some months, to be attended with suffering. The uterus in such cases sometimes presents some other deformity, such as elongation of the cervix, or stenosis of the os; or it is attached to a vagina with unusually short walls.

ii. *Changes in the uterus.*—Inflammatory changes in the uterus may lead to an induration of the walls that gives a proclivity to anteversion, or to relaxation or atrophy of the tissues at the isthmus which will favour exaggeration of the normal anteflexion. But by far the greatest number of women who have pathological anteflexion of the uterus have also—

iii. *Changes in the ligaments.*—It is in inflammatory contractions of the utero-sacral ligaments that we so frequently find the explanation of this distortion of the uterus. As they lay hold of the isthmus these ligaments, when they become shortened, drag the cervix uteri towards the hollow of the sacrum; and, as the body of the uterus retains its mobility, it becomes bent in an exaggerated degree by the pressure of the superincumbent structures: the organ as a whole loses its power of adapting itself to the movements of the adjacent organs. The same effect is sometimes produced when adhesions have formed in the pouch of Douglas which fix the cervix to the rectum but leave the fundus free to become permanently anteflexed.

iv. *Directly displacing influences.*—Whilst increased weight or relaxation of texture of the uterus, and abnormal shortenings of its posterior ligaments, favour the occurrence of the anterior deviations, they are directly produced by pressure bearing on the posterior surface of the organ. The ordinary intra-abdominal pressure may of itself produce the result under favourable conditions; but in some patients there is further pressure from the presence of tumours, or even from habitual constipation. In some very rare instances the uterus is fixed forward, as the result of inflammatory adhesions that have formed between the fundus and the bladder or anterior abdominal wall.

The causes that bring about the displacement very commonly remain, to some extent, as complications of the mischief; and they have to be carefully kept in view in the treatment of every case: moreover, as many of these patients become the subjects of salpingitis and oophoritis as well, the possibility of these complications being present must never be forgotten.

The **symptoms** that chiefly attract attention here are dysmenorrhœa and sterility. The patients may also have leucorrhœa, or trouble with the bladder or bowels, or be the subjects of pelvic and other pains; but, for the most part, they come under observation as young unmarried women suffering from dysmenorrhœa, or as young married women who have never conceived, and are perhaps also dysmenorrhœic. The menstrual pain is often due to the chronic utero-sacral cellulitis or other conditions causing the displacement; sometimes it is due to the stenosis that complicates it; sometimes it is to be referred to the endometritis that may in one patient be the cause of the anteflexion, and in another the consequence of it. There are yet others where the flexion leads to suffering because of the obstacle to the easy outflow of the menstrual fluid from a uterus that has lost its erectile property. As regards the sterility, we note that, whilst we find retroversion in a large proportion of the women who have given birth to one or more children, and then have acquired sterility, a greater number of those who are absolutely sterile, and have never conceived at all, are the subjects of anteflexion of the uterus. As with the dysmenorrhœa, so the sterility may sometimes find its explanation in the concomitant conditions; but, when these have all been combated, there remains a group of cases where the patient does not conceive until means are used to correct the displacement.

The **diagnosis** is made by bimanual exploration, which enables us to make out the size, direction, and relations of the uterus. The posterior parametritis or perimetritis that may have been the prime factor in bringing about the anteflexion is very likely to have produced at the same time some degree of retroposition of the organ, so that an imperfect exploration may lead to the diagnosis of a retroversion. Even with the greatest care it is in some patients difficult to make out the exact position of the fundus, unless the abdominal walls are thin, or the muscles are relaxed under chloroform. The sound is often helpful in determining the direction of the fundus. To facilitate its introduction it may have to be bent pretty sharply towards the point; but the most important matter to attend to in employing it in these cases is to avoid force in passing it onwards. When the point meets with resistance at the flexure, the handle should simply be pressed backwards towards the perineum, when the finger in the anterior fornix will feel the body of the uterus settle down over the end of the instrument, and the diagnosis is made sure.

The **treatment** must have regard, in the first instance, to the various conditions that may be found causing or complicating the displacement. Until the hypertrophied uterus is reduced in size, its tense ligaments relaxed, and the inflammatory processes in and around it subdued by the use of douches, vaginal plugs, medicated pessaries and the like, it will be vain to attempt to relieve the patient's symptoms by mechanical measures calculated to correct the uterine displacement. For some gynæcologists the treatment of pathological anteflexion would simply resolve itself into the treatment of uterine or pelvic inflammations. But it is to be remembered that the resorption of inflammatory deposits may sometimes be favoured by the appliances that have, at the same time, the effect of improving the position of the uterus; and if symptoms remain unrelieved by other measures, there is a clear indication for their employment. It has been found time after time that an intra-uterine stem pessary has promoted the disappearance of the endometritis which attends anteflexion; dysmenorrhœic patients have menstruated without suffering; the uterus was thus kept straight, and women previously sterile have conceived with the stem in the uterus. It must be borne in mind that with any active inflammation in or around the uterus the employment of stem pessaries is a source of danger, whether in the posterior or in the anterior displacements. The instruments used should be carefully sterilised and applied with antiseptic precautions. When the intra-uterine stem is to be worn for some time it is usually necessary to introduce vaginal plugs below it, or to apply a vaginal pessary. In cases of anteversion a vaginal ring or a figure-of-eight pessary is often of use in relieving some of the pressure symptoms.

Operative measures of various kinds, such as the fixation of the cervix to the anterior wall of the vagina in cases of anteversion, and opening the pouch of Douglas to allow of removal of wedge-shaped pieces from the back of the uterus in cases of anteflexion, have been proposed and carried out. But though the operators have given favourable reports of their cases, the operative treatment of the anterior displacements of the uterus does not offer much prospect of triumph for plastic surgery.

III. Lateral Deviations.—Lateral deviations of the uterus are occasionally met with in practice; there may be dextroversion or dextroflexion when the uterus is turned or bent towards the right, or sinistroversion or sinistroflexion when the deviation is towards the left side of the pelvis. These variations are usually found, however, as subsidiary phenomena in association with inflammations, hæmatomata, or other tumours; or they may complicate the anterior or posterior displacements of the organ. Hence they are of relatively small clinical importance; they give rise to no distinctive symptoms; and their diagnosis and treatment are to be conducted according to the principles applicable to the detection and treatment of the more common deviations.

A. R. Simpson.

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A. R. S.

CHRONIC INVERSION OF THE UTERUS

INVERSION of the uterus has been a favourite theme for essays. Its occurrence is far from common: eminent consultants of exceptional experience have never met with it; practitioners engaged in large midwifery practice have never seen a case. It was found at the Rotunda Hospital once in 190,800 deliveries. At the Vienna Lying-in Hospital 250,000 births occurred without a single instance. I have found two cases of recent inversion in the records of over 20,000 labours to which I have access; and in twenty-five years' practice four instances of chronic inversion have come under my own care, while I have seen several more in the practice of others. Possibly it has happened without recognition, or at any rate without publication, in some instances.

An inverted uterus, as the name implies, is the uterus turned inside out; the lining mucous membrane becomes external, the serous peritoneal membrane internal. It may be puerperal or non-puerperal: in the former it is associated with labour or is the result of pregnancy; in the latter it is allied with certain tumours or growths in the non-pregnant uterus. The puerperal condition is responsible for the great majority of cases—as many as 87·5 per cent. Most of them happen at or near the termination of labour. Of the 224 cases collected by Crampton, 196 are noted as having occurred at once; that is, at the end of the process of confinement. We may divide the disease into acute and chronic; the date of completion of the involution of the uterus, about six weeks from the date of labour, being the dividing line between them.

In the puerperal variety, inversion of the uterus may be looked upon as chronic when it persists after the regenerative changes which are normally effected after delivery. The usual reconstitution of the uterus may be retarded or perverted by the conditions of the particular case; but the interval of time forms a valid ground for definition and for treatment. Chronic inversion is a sequence, then, of the acute form, and is due to failure of reduction before the time allowed for reparation of the puerperal uterus, and further includes cases occurring independently of pregnancy—those which happen as a complication of some tumours, malignant or innocent, in the uterine walls.

Anatomy and Pathology.—Various degrees of inversion are described. According to Crosse, partial inversion is present in its slightest degree when any portion of the entire thickness of the walls of the uterus becomes convex towards its cavity or interior; although this may not be invaginated, or brought within the grasp of the rest of the uterus. It may accompany the projection of a tumour into the cavity; thus the peritoneal space has been opened in dividing the base of a tumour for its removal. One horn of the uterus may occasionally be indented. In cases of post-partum hæmorrhage, with a large and flabby uterus—especially where efforts are made by external pressure to force the uterus into contraction—we not infrequently find the wall to yield and partial depression to follow. This is more likely to occur when the hand is pressed against the uterus, instead of grasping it after the method of Crédé.

The body of the uterus may be inverted as far as the os internum; or there may be complete inversion of the body through the cervix into the vagina, or even externally. Generally the cervix remains, forming a distinct fold or ridge around the neck of the inversion. This fold varies in depth according to the extent to which the cervix is involved, being, as a rule, rather deeper in front than behind. When the uterus descends externally it is usually accompanied by inversion of the vagina.

The form of the inverted uterus is round or pear-shaped, with a well-formed but smaller base. The shape varies somewhat according to the degree of inversion and the pressure to which it is subjected by the constricting ring of the cervix; or, when lower down, by the opposing contact of the vaginal walls. It may be firm and tense, softer and more yielding, smoother and more velvety to the touch. The surface of the mucous membrane may be red, or congested and purple; usually it is less pink than a fibroid, it may present ecchymosed spots, or show erosions and ulcerations which, in a few instances, have formed adhesions to apposed surfaces of the cervix or vaginal walls. It bleeds freely when handled. When the inverted surface is exposed to the air for any length of time the mucous membrane may lose its normal characteristics, and become dry and wrinkled like that of a procident vagina.

Inflammation and even gangrene have followed the arrest of blood-supply and the perverted nutrition due to the incarceration; and in some rare instances sloughing of the inverted portion has taken place.

The peritoneal invagination contains, at the beginning,[1] the broad and round ligaments, the Fallopian tubes, and the ovaries. Sometimes, at the first rush, a loop of small intestine is drawn into the cavity. After a time, when contraction takes place, the ovaries and tubes recede outside the space; and the margin of the opening remains as a firm ring into which the finger can hardly pass. It rarely happens that any adhesion takes place between the peritoneal surfaces, though this has occurred. In cases of non-puerperal origin, when the formation of the inversion is more gradual, part only of the Fallopian tubes and broad ligaments are found in the invaginated space.

Mechanism of Production.—Inversion begins generally at the fundus; occasionally at the sides, posteriorly, or at the cervix.

It has long been considered that enlargement of the uterine cavity, associated with some cause capable of exciting contraction of its fibres, are the two conditions essential to inversion. That the uterus often contracts irregularly, one part being firm, another relaxed, is well known. Most authors speak of the important part taken by modifications of the placental site in causing inversion at this part: the wall of the uterus is thinner and more lax; its structure is modified; it is generally more yielding and weaker. Klob says defective contraction of the part of the uterine wall which forms the placental insertion is of extraordinary importance; he describes it as sinking inward into the uterine cavity while other parts of the organ seem tolerably well contracted.

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[1] Svensson amputated an inverted uterus three months after delivery, and found in the extirpated mass both the ovaries and the greater portion of the broad ligament (Sajous, 1889, i. p. 23).

Matthews Duncan devoted special attention to this subject, and formulated his views respecting it with much emphasis. His views appear to be the outcome of a concise and logical interpretation of facts which afford a rational explanation of the phenomena observed. He divides inversion after delivery into active and passive, and describes a spontaneous and an artificial variety of each. The only condition essential to the production of the passive kinds is, he says, paralysis or complete inaction; in the artificial kind, the accident is accompanied by partial uterine activity with partial paralysis. He affirms that activity of the whole of the uterus, or of its body, renders inversion impossible.

Force may be applied from above to push the paralysed wall into the uterine cavity, or from below to pull it into the cavity. In the spontaneous kinds this force is to be found in the mechanical conditions of the abdomen, in the ordinary down-bearing effort, or in an absence of the retentive power of the cavity however produced. In connection with the artificial kinds I may refer to cases where the cause is to be found in pulling upon the cord—"manœuvring with the placenta," as Matthews Duncan aptly terms it. No doubt when the placenta is attached to the fundus the disposition to inversion is aggravated by traction.

On the whole it may be considered that traction of the cord as a cause of this accident is overrated, especially in modern times, when better knowledge commands more accurate management of the third stage of labour. Shortness of the cord, whether in length or from coiling, has not the importance formerly attributed as a cause—unless, indeed, the labour be precipitate or the patient rapidly delivered in the upright position.

Active spontaneous inversion is probably the most common kind: paralysis of a portion of the fundus or placental site leads to the depression; the paralysed projecting part is further seized, pushed down, and expelled by the contracting parts through the os uteri into the vagina.

That inversion may begin at the cervix has been clearly demonstrated by Taylor of New York in a case of his own: the condition began by eversion of the os, and rolling of the body and fundus out of the cervix. Matthews Duncan admits that, under powerful contraction of the fundus and relaxation of the part below, inversion of the lower part only of the cervix may occur; and he says that this even is not rarely observed after delivery. He depicts diagrammatically the extent to which the change may go in the direction of inversion, but does not say that he has seen it occur in the complete degree observed by Taylor.

That spontaneous inversion of the nulliparous uterus can take place has been strongly denied, but the case recorded by Taylor is a clear proof of its occurrence, and other instances recorded by careful and competent observers confirm it.

Etiology.—In the first place the changes coincident with pregnancy and parturition undoubtedly have the largest share in disposing to this accident. By far the greater number of cases occur in primiparæ. In Crampton's collection of cases 88 out of 176 were after first labours. It may also happen in conjunction with abortion, generally as the result of accident or some applied force.

Conditions in some respects analogous to pregnancy also act, though much more rarely, as disposing causes. Distension of the cavity and relaxation of the walls of the uterus, deficiency in muscular tone and irregular or imperfect contraction, all tend to favour its production. In women of feeble constitution, more particularly after severe hæmorrhage when the uterus is flaccid, the liability is greater. Some individual peculiarity is also exhibited in those women in whom inversion has taken place in successive confinements.

In the presence of morbid growths of the uterus there is, as a rule, dilatation of the cavity, especially when the tumour is attached to the fundus. Of the 400 cases given by Crosse, 50 are noted as connected with tumours. With pediculated fibroids it may occur spontaneously; or again, after removal of an intra-uterine tumour with a broad attachment. Some alteration in the walls of the uterus at the site of the growth, contractions at the menstrual periods, and intra-abdominal pressure, are the usual conditions which cause the body to be projected through the cervix. In sarcoma this is more frequent: A. R. Simpson met with it in 4 cases out of 48. It rarely occurs with carcinoma, but Barnes mentions two cases.

Symptoms.—When this event in its puerperal form occurs suddenly and completely, the symptoms are those of profound shock and collapse, accompanied by intense pain and hæmorrhage. The pain is fixed and persistent; the bleeding continuous and profuse. The absence of the uterus from its normal position will remove all doubt as to the nature of the accident. In the partial form the symptoms are not so characteristic; indeed, unless a thorough examination be made at the time, the accident may escape observation.

In chronic inversion the symptoms are anæmia and impaired health; irregular hæmorrhages, often profuse; discharges; sometimes urinary troubles; local pain and discomfort; difficulty in walking. In this way women have been known to drag on a miserable existence for many years, and die ultimately of exhaustion, peritonitis, or septicæmia. In some instances, however, patients have reached advanced age without any discomfort, and even without knowledge of their ailment; others have suffered little more than inconvenience from the displacement. Such immunity has generally been observed in cases occurring after the climacteric period.

Diagnosis.—In a simple case the diagnosis is easy. In complex cases definite diagnosis is sometimes attended with difficulties which even experts have not been able to overcome. The history of the case should be carefully inquired into; it is suggestive, and of consequence in distinguishing the puerperal from the non-puerperal variety.

On examination a smooth pyriform or round tumour is felt in the vagina, or protruding through the cervix; it bleeds readily when handled. The cervical ring is often high up, and the fold of the cervix can be felt all round; if traction by a fillet or noose around the body be possible the fold can be made to disappear—a fact of some importance in differential diagnosis from polypus. The depth of the cervical depression depends upon the extent of the inversion.

In the dorsal position, with two fingers in the rectum and the opposing hand placed over the hypogastrium, the body of the uterus is noted to be absent from the normal position, and the fingers of the hands can be made to meet. The two forefingers of opposite hands in the vagina and rectum respectively may also be made to approach each other over the inversion. The recognition of the peritoneal orifice of the inversion when it can be felt through the rectum or through the abdominal wall is of much importance. A sound passed into the bladder, with the concavity turned backwards, can readily be met by a finger in the rectum above the inverted uterus. If the inversion can be brought into view by a speculum, or by sufficient traction, the colour may be noted, and possibly the openings of the Fallopian tubes made out.

The sensibility of the inverted uterus to puncture or pressure is not always a trustworthy sign; nor is its absence by any means pathognomonic of a polypus. As pointed out by Newnham, the sensibility of the uterus, on the one hand, may be diminished in the chronic stage of inversion; and, on the other, it may be increased in polypus by inflammatory action. Again, if a polypus be covered by a layer of uterine tissue the distinction, whether with regard to colour or sensibility, is less appreciable.

Differential diagnosis.—When a *polypoid tumour* is present in the vagina its attachment can generally be reached, and a sound can be passed through the cervical opening into the uterus for some inches. Adhesion round its base sometimes precludes the use of the sound. Bimanually, or by recto-abdominal touch, the body of the uterus can be defined in its usual position, or sometimes it is retroverted. It is between partial chronic inversion and polypus that great difficulty in forming accurate conclusions is sometimes found. Velpeau, quoted by Simpson, says that there are cases in which doubt is the only rational attitude.

The history of the case, as I have said, is significant. In a case of polypus the distance the uterine sound can be made to pass is a trustworthy criterion. The presence of the uterus in its normal position, and the absence of any trace of depression on bimanual examination, are the most valuable signs. If the tumour be sufficiently low for traction to be made upon it, in inversion the remnant of the cervical canal can be made to disappear; while in polypus, by the same means, the whole uterus with the attached tumour can be made to descend. The co-existence of the two conditions—polypus with partial inversion at the site of attachment to the uterus—presents still more treacherous ground for differential diagnosis. Here we must rely mainly upon the onset and progress of the symptoms, together with a thorough bimanual investigation. The use of the uterine sound here renders no aid; but possibly the depression or dimpling of the uterus may be felt by the combined use of the hands. In such cases it would be justifiable to dilate the uterus and, under an anæsthetic, to examine the internal and external surfaces more exactly.

Numbers of cases are recorded, in the practice of experienced men, in which the inverted uterus, or one horn of the inverted uterus, has been operated upon, by ligature or otherwise, for supposed polypus; and, conversely, others in which polypoid tumours have been removed under the impression that the operator was dealing with an inverted uterus.

From *prolapse* of the uterus the diagnosis should be easily effected. The procident mass is wider above than below; at the lower end the orifice of the os uteri can be seen, and a sound passed into it. These points will suffice for the purpose. Moreover, the sound passed through the urethra goes downward in prolapse, upward in inversion. Manipulation detects the body of the uterus and the elongated cervix, which in prolapse are readily movable; while examination by the rectum and recto-abdominally shows clearly the relative position of the parts. In old-standing cases inversion is often attended with some degree of prolapse; and when marked the vagina may also be inverted. In this event bladder troubles are considerably increased.

Course and Results.—In some rare instances there has been toleration of the malady for many years after involution has taken place, and more particularly when the menopause has been passed.

Occasionally, as before stated, inversion has been present without the knowledge of the patient, though as a rule there is continuous suffering. In some cases spontaneous reinversion takes place; well-authenticated examples of such have been observed by Sir John Williams and Dr. Herbert Spencer. Dr. Thomas collected twelve cases; another is reported by Kemarski; a third happened, under the care of Schultze, after the removal of a myoma from the fundus. In this case the reinversion began at the cervix and was fully effected in about ten days.

The usual course is one of discomfort, irregular hæmorrhage, septic absorption, attacks of pelvic inflammation, and exhaustion, until reduction brings relief, or death supervenes. The general mortality is estimated by Crampton at 20 per cent; out of 120 recent cases 32 died, of 104 chronic cases 7 died.

Treatment.—The difficulties of reduction in chronic inversion of the uterus are exemplified by the infinite variety of methods employed or recommended by various authors. It must be granted that there is no one plan universally applicable. If one method is unsuccessful success may be attained by another, or by a combination of methods.

The chief obstacles to reduction are the rigidity of the cervical ring, with, in recent cases, increase in the volume of the uterus. Another obstacle is found in the mobility of the uterus and in the difficulty of obtaining adequate counter pressure to the force applied from below. Peritoneal adhesions are not frequently met with; they are more often surmised than found. Experience shows that, even when desired for the closing of the inner opening, they are hard to produce artificially.

In the commonest form of inversion, as pointed out by Schultze, there are two rings of the uterine wall one within the other. If the reduction is begun by seeking first to press the fundus upward by indentation a third ring is produced, which, unless the cervical constriction be already dilated or dilatable, obviously increases the difficulty. The proper method is to grasp the inverted body and to press it upwards, so that the cervix may be dilated, and may be first reduced: thus we imitate the method by which spontaneous reinversion takes place.

Ingenuity has been shown in mechanical contrivances, skill and dexterity in shrewd adaptations, and exemplary patience in manual efforts. The records of many isolated cases have contained the germs of explanation and suggestive reasoning. From the special to the general the deduction is conclusive that steady and sustained elastic pressure is the treatment likely to be attended with the greatest amount of immediate success and the best ultimate results. There is apparently no limit to the time when it may be employed with benefit; in cases of many years' duration it is still applicable.

The principle of sustained pressure may be applied with the hands, with instruments, or by a combination of elastic bands with appropriate instruments; the main object being to dilate the cervical ring and to restore first the part last inverted.

The methods may be classified as follows:—

(i.) Reposition by hands: (*a*) aided by incision (cervical, uterine, abdominal); (*b*) aided by instruments. (ii.) Elastic sustained pressure. (iii.) Amputation; vaginal hysterectomy.

Preliminary treatment.—In all cases some preparatory treatment is desirable. The patient for some days beforehand should be kept in bed, the diet regulated, and the bowels well moved. Free vaginal injections of hot water, followed by a lotion of mercuric perchloride (1 in 2000), should be used night and morning.

Manual reposition.—In attempting manual reposition the patient should be placed in the lithotomy position at the edge of a level table. A Clover's crutch is used, and an anæsthetic must always be administered.

Emmet's method is as follows: The hand is placed in the vagina, the fingers and thumb encircling the portion of the body close to the seat of inversion, the fundus resting in the palm of the hand. This portion of the body is firmly grasped and pushed upwards, and the fingers are then immediately separated to the utmost. At the same time the other hand is employed over the abdomen in the attempt to roll out the parts forming the ring, by sliding the abdominal parietes over its edge. As the transverse diameter of the cervix and os is increased by the outspread fingers the long diameter of the body becomes shortened. In one of Emmet's cases reduction was completed in three hours and fifty-five minutes. In another, after three hours' effort, the treatment was stopped for the time and resumed a month later. On this occasion, five hours, with change of operators, were spent without success; but finally, a week after this attempt, the inverted uterus was completely reduced in twenty-seven minutes by the same method. To aid fixation the uterus was drawn down to the vulva, and the edge of the cervix on each side seized with tenacula, which, however, frequently tore out. Aran recommended Museux's forceps or tenaculum hooks for this purpose; and Freund introduces broad silk ligatures at several points of the circumference, and thus forcibly drags down the vaginal portion while pressing the body upwards.

Noeggerath compresses the body of the uterus, opposite to each horn, by the thumb and finger, so as to indent it on one side or the other. When this can be effected the indented horn acts as a wedge which facilitates the passage of the remaining portion of the body. Marion Sims succeeded readily in pushing in this part of the uterine wall after the body had entered the cervical ring—a method previously advocated by Kiwisch.

Courty insists upon the necessity of keeping the cervix fixed with two fingers introduced into the rectum. The cervix is drawn down outside the vulva and held with Museux's forceps: the index and middle fingers of the left hand are then introduced into the rectum, and by bending them forward the cervix is easily fixed through the rectal wall. With the right hand the uterus is pushed back into the vagina—the fundus, contained in the palm of the hand, being turned towards the pubes. With the thumb and index finger of the right hand pressure is exercised on the pedicle of the tumour, so as gradually to increase the depth of the utero-cervical groove.

Watts of New York easily effected reduction in a case by the following plan: "The uterus is drawn down to the vaginal outlet, two fingers are placed in the rectum, one of these through the wall into the depression; the uterus is then pushed on to it from the vagina, the second finger is then added to the first, and when sufficient dilatation of the ring is ensured the uterus can be returned."

Incision.—Sir James Simpson (112) found that in forcible reposition the edges of the cervix were fissured or slit; he therefore suggested incision as an aid. Marion Sims also proposed the same method.

It was also advocated by Barnes and Matthews Duncan, and in recent years has been employed by Küstner, who describes his method as follows:—

In the dorso-gluteal position the inverted uterus was drawn firmly downwards with volsella forceps, so that it lay in the vulva; Douglas's pouch was opened, and the index finger of the left hand was inserted into the inversion infundibulum. As the latter was free from adhesions, it was possible to get quite to the bottom of it, and with the index finger of the left hand in the infundibulum he cut longitudinally for a length of 2 cm. through the posterior wall of the uterus, exactly in the median line, in the region of the inner os uteri. Reinversion was then easily accomplished. The reinverted uterus was firmly retroflexed; the longitudinal wound in the posterior wall of the uterus was drawn with a volsella forceps into the wound of Douglas's pouch, and sutured by three deep and two superficial sutures; thereupon the wound in Douglas's pouch was also closed with five sutures, the result being recovery without febrile reaction.

It has been found, by Piccoli and others, that dilation of the inversion ring is not necessary, for reposition can be accomplished readily when the incision is extended sufficiently through the external os to cut through the constricting fibres. Spinelli modified this plan by opening the anterior cul-de-sac by a transverse incision, and splitting the front wall of the uterus in the median line from the external os to the fundus. After reducing the uterus he closed the incision by catgut sutures, and fastened the uterus forwards by vaginal fixation. This plan has been practised successfully by others.

There is some trouble in bringing the edges of the uterine wound together, which is done by deep sutures down to the mucosa, and superficial Lembert sutures on the peritoneal aspect. Prof. J. W. Taylor in one case sought to facilitate the closure by removing a wedge-shaped piece of the uterine wall on each side of the incision, a method which might possibly weaken the wall in case of subsequent pregnancy.

The trend of modern opinion is directed more to the surgical and operative treatment of chronic inversion than to the slower, though oftentimes safer methods. The vaginal route for such operations appears to afford a greater number of successful cases than the abdominal, the figures showing a result of 88 per cent of cures in the former as compared with 53 in the latter. Success evidently depends much upon straightway proceeding to operation without previous attempts at reduction or manipulative interference.

Incision through the abdomen.—In 1869 Gaillard Thomas reported a case in which he carried out a novel plan and achieved a great success. The patient, twenty-three years old, had borne one child twenty-one months before. Fourteen determined and prolonged attempts by experienced and able men had failed to reduce the inversion. On the last of these attempts Thomas incised the site of the stricture, when a nearly fatal hæmorrhage followed. A week later the abdomen was opened in the median line, and the internal ring was dilated by specially made forceps. A rent was made in the anterior vaginal wall by the force used from below. The operation under ether lasted one hour, the actual replacement occupying twenty-seven minutes. The patient made a good recovery. In a similar case under his care the replacement was easily effected, but the patient died from peritonitis forty-eight hours afterwards. This plan has been tried by others with indifferent success. The principle, however, is a rational one; it is offered as a substitute for amputation of the uterus after all other means have been fairly tried, and as such it must be considered a valuable contribution to the methods of treatment at our disposal; it is certainly not more difficult, and it is less dangerous than amputation.

In 1885 I published a case in which reduction was attempted on somewhat similar lines. After repeated efforts by taxis and pressure the abdomen was opened and the constricted ring dilated by bone glove-stretchers. A thread of whipcord was then passed from above through the fundus, and a button was attached to the distal end. Continued upward traction for nearly an hour failed to produce any appreciable degree of replacement. Two weeks later the condition of the uterus induced me to remove it through the vagina by elastic ligature. The patient made a rapid recovery.

Sustained pressure.—Sustained pressure has been applied in a variety of ways. Tyler Smith in 1858, by the use of elastic pressure, made an important advance upon the former methods of treatment. He succeeded by placing a Gariel's air pessary in the vagina, external pressure being exercised by a T-bandage and a graduated compress placed at the vulva. In one instance a case of twelve years' duration was cured after pressure maintained for over a week. By this means slow and gradual dilatation of the os is produced, with softening of the cervical ring, whereby opportunity is given for the inverted uterus to recover itself, or assistance may be given by the hand. Thomas modified this plan by packing round the inverted uterus tampons of carbolised cotton soaked in glycerine; then he introduced an india-rubber bag filled with water, and retained it in position by a broad strip of plaster passing between the thighs from the lumbar region behind to the umbilicus in front. Pressure was regulated by injecting more water, or letting some out by means of a stop-cock. As already noted, the same principle has been adopted in a more manageable form by the use of Barnes' bags filled with air. "A bag consisting of a double-walled india-rubber capsule which is slipped over the uterus has been devised by Thiry. When distended with air it presses and pushes up the inverted fundus."

Elastic pressure.—This is by far the most efficient method yet known. The cardinal points are that it should be gentle, elastic, and sustained in the direction of the pelvic axis. It must be repeated again and again, if necessary, and kept up persistently and perseveringly with vigilant care.

With this method in view, previous prolonged handling, squeezing, and pressure by taxis are unwarrantable. It is wiser and safer to begin with it at once after preliminary antiseptic irrigation. Aveling's repositor is the best means of producing the pressure; it consists of a stem with a double curve—perineal and pelvic—surmounted by a cup which is placed against the fundus. The pressure is exerted by four elastic rings fastened by bands to a waistbelt, which in its turn is supported by shoulder-straps. By the adaptation of these the degree and the direction of the pressure can be very fairly regulated. Cups of different sizes are iade to fit the stem. When the inversion is reduced the cup is somemes retained within the uterus, and is not easily extracted. This ifficulty is obviated by having the cup or cylinder perforated with oles, so as to remove the pressure from the air. In one case I had onsiderable difficulty in getting it out. The patient should be examined very few hours, and when the fundus is reduced to the level of the xternal os, a smaller cup or cylinder should be placed on the end of he repositor, taking care to see that it does not slip on one side. The lastic bands should at the same time be carefully readjusted.

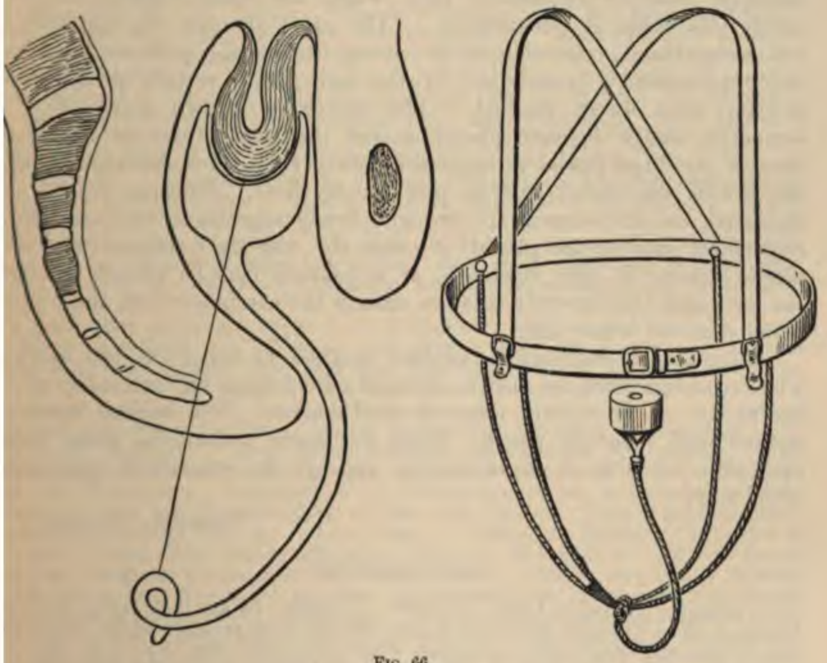

Fig. 66.

In a case under Scanzoni's (105) notice the button end of a stem was etained under similar circumstances. The advice he gave was that as the tem had entered by firm and persistent pressure it should be removed by he same means. Galabin obviates this danger by making the cup form he summit of a cylinder 1¾ inch long. Thus the cervix is prevented rom closing up after reduction, when the instrument is readily removed.

Careful watching is necessary when the instrument is in place: the bands may require tightening at intervals, and, if there be much pain, opiates must be given. Restoration is generally effected by this plan within forty hours. In one of my own cases three days elapsed before he reduction was complete, but it was necessary to suspend it for some ours on account of the pain produced; in another case it was effected in

36 hours. Aveling states that a pressure of 2½ pounds is sufficient to effect reduction. He reports eleven cases successfully treated by this method, and goes so far as to say that every case of inversion can be cured by reposition. However, he subsequently recorded one where it did not succeed. Where a fibroid tumour or polypus exists in connection with the inversion it should be first removed by enucleation or excision.

Amputation.—The mortality of this operation was at one time as high as 30 per cent. It should only be practised as a last resort, and indeed, in the light of present knowledge, the instances in which it is required must be excessively rare, when the relative infrequency of irreducible cases is remembered. The chief dangers of amputation are hæmorrhage, retraction of the stump within the peritoneal cavity, and septicæmia. Amputation by the knife, with certain precautions, is the most direct method. The uterus is drawn down and a temporary elastic ligature placed around the neck; three or four wire sutures are then passed through the cervix from before backwards, and the uterus amputated half an inch below these. Bleeding points are ligatured, and the sutures are brought firmly together over the stump. Superficial sutures are placed to unite the mucous membrane, and the elastic ligature is now removed; or a ligature may be passed through the neck and tied laterally so as to control the uterine vessels, the uterus being removed below this.

Vaginal hysterectomy is another method of removing the uterus. The broad ligaments are tied or clamped with forceps on both sides, when the uterus can be rapidly removed with scissors. The vaginal space is packed with iodoform gauze. Rigid antiseptic precautions place these operations on a more secure footing, and greatly enhance the prospects of recovery.

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INFLAMMATION OF THE UTERUS

FEW subjects in gynæcology are so difficult to handle as inflammation of the uterus. Seldom fatal, and therefore not lending itself to the precise methods of the pathologist, its pathological anatomy is being but slowly worked out. Clinically it includes a long series of cases showing the most varied changes. Beginning with those in which the only symptom is pain, and the only physical sign undue sensitiveness on examination,—cases which led that careful clinician Gooch to describe what he called the "irritable uterus,"—it further signifies groups of cases which show all the marks of local inflammation, but usually present no distinct line of demarcation between the acute and the chronic. Besides being rarely fatal—except in cases of puerperal sepsis, which belong rather to the domain of obstetrics than of gynæcology—another peculiarity of inflammation of the uterus is the rarity of suppuration, which in other organs is so common a result of inflammation. We are not surprised, therefore, to find a great divergence of opinion among leading gynæcologists in Britain and elsewhere on the nature and relative importance of the various forms of uterine inflammation.

A retrospect of the opinions held during the last half-century on the significance of the various inflammatory lesions in the pelvis brings out two curious points. The first is the influence of methods of examination in accentuating a lesion. The speculum concentrated attention on the cervix; the sound on the position of the uterus; the bimanual examination on the cellular tissue and peritoneum; the exploratory incision on the uterine appendages; the microscope on micro-organisms. On the introduction of each of these methods of examination the corresponding lesion has been emphasised out of proportion to the rest. An expert in any one of these methods of examination is disposed to say—This is the lesion, and there is no other. At present abdominal section and the microscope hold the field; and a historical survey warns us that at the present time we are exposed to the danger of emphasising the significance of inflammatory lesions of the uterine appendages, and even of the part played by micro-organisms, at the expense of other lesions and other factors of no less importance.

The second striking feature in such a retrospect is the progress in the mode of regarding disease. Half a century ago the standpoint was a symptomatic one. Tyler Smith's book on *Leucorrhœa*, in which the most varied conditions are grouped together because they have this symptom in common, is an illustration of the symptomatic standpoint. At the present day the standpoint is pathological; the "entity leucorrhœa" has been replaced by "endometritis" and "cervical catarrh," under which names the lesion is localised and described. But the changed standpoint does not simply mean seeing another side of the same thing. We are not merely walking round a hill, we are ascending it; the pathological standpoint is a step higher than the symptomatic: a step higher still will bring us to an etiological standpoint, inasmuch as etiology deals with causation, and is the basis of preventive medicine. Where it has been demonstrated, as in the case of gonorrhœa, that the inflammatory conditions of the uterus are due to a micro-organism, this view of inflammation from the etiological standpoint has simplified our conception of it. Instead of being broken up artificially into different affections according to the tissues involved for the time being, it has become a uniform organic process gathered round the life-history of a micro-organism. Clinical experience tells us that this is the true mode of regarding it.

And yet, if it should be shown that all the changes which we associate with metritis have a microbe at the bottom of them as the essential factor in their production, this would not produce a great revolution in our conception of metritis; although it would materially influence our treatment in so far as it might emphasise preventive treatment by antiseptics. After all the micro-organisms have been discovered and described, attention will revert to the local and general conditions which determine their growth. If the microbe or spore be the seed, the uterus is the soil; and those subtle influences which we speak of as constitution and diathesis are the climate. The seed is an essential factor in plant life; but equally important factors for development and growth are soil and climatic conditions. The discovery of the seeds has for the time thrown the study of constitutional states and diatheses into the background. But because we know little about them we need not minimise their influence. No science is so vague as meteorology, and yet nothing bulks so largely in the farmer's mind as the weather. Of the importance of soil no better illustration could be found than in the case of the puerperal uterus. When we discuss the relations of micro-organisms to endometritis we shall find that the reason why they are able to penetrate into the uterus during the puerperium is to be found in the altered condition of its cavity.

To Henry Bennet is due the credit of drawing attention to the importance of inflammation of the uterine mucous membrane. Although he described it as in many cases going on to ulceration, so that his opponents fastened on the alleged "ulceration" and criticised it as the essence of Bennet's teaching, it is only fair to him to say that he regarded ulceration as but one of many phases of inflammation. Perhaps he laid himself open to criticism by stating that inflammation was to be treated by surgical means.

Bennet's views were opposed by Lee, West, and Tyler Smith. In reading their criticisms it is interesting to come upon statements, then based only on clinical observation, which have since been established by microscopic investigation. Thus Lee, speaking of the appearances which Bennet described as ulceration, says: "These apparent granulations are usually considered and treated as ulcers of the os and cervix uteri, but they do not present the appearances which ulcers present on the surface of the body or in the mucous membranes lining the viscera, and they are not identical with the granulations which fill up healthy ulcers. They present the appearances often observed on the tonsils which are said to be ulcers, and are not." Thus Lee, writing in 1850, forecasts the work of Ruge and Veit in 1878. The comparison of the "ulcerated" cervix to a hypertrophied tonsil is a happy one. So also Tyler Smith forestalled the view of Emmet and Roser, that the appearance is produced by an ectropion of inflamed cervical mucous membrane, when he says: "The granulations which are sometimes found surrounding the os uteri—which may secrete mucus or pus abundantly, and which may bleed on being roughly handled—are, I have no doubt, the result of inflammation; but they resemble the granular state of the conjunctiva rather than the granulations of a true ulcer, the granular os uteri offering no edges or signs of solution of continuity by which we might satisfactorily declare it to be an ulcer."

Unfortunately, and in spite of such criticism, the term "ulceration," introduced by Bennet, took hold of the professional mind. It led to a routine treatment of inflammatory conditions of the cervix by caustics, as slowly healing ulcers in other situations are treated. An erroneous pathology opened the door for a pernicious treatment, from which British gynæcology suffered until it found a true pathological basis.

Etiology of Uterine Inflammation.—While for descriptive purposes we divide inflammations of the uterus into inflammation of the cervix or cervical catarrh, of the mucous lining of the body or endometritis, and of the substance of the uterus or metritis, it must be borne in mind that no one of these occurs by itself. Before looking at these conditions separately it will be convenient to consider the etiology of all three together, inasmuch as they are produced by the same causes. Clinically the inflammation is not limited to any one tissue; and all that is meant when a case is spoken of as endometritis, is that the changes in the mucous membrane in the body of the uterus are for the time being more prominent.

In studying the etiology of inflammation of the mucous membrane of the uterus, we must bear in mind that the uterine mucosa is not functionally analogous to other mucous membranes, as for example those of the stomach, the respiratory tract, or bladder. These belong to organs whose function is constant and necessary to life. They are in daily use, but the function of the uterus, namely, reproduction, is only called into exercise occasionally. Even the periodic changes connected with menstruation can hardly be considered as a function necessary to life, for there is no evidence to support the old idea of its being a monthly cleansing or katharsis, a view which would make the uterus practically an excretory organ. Menstruation is connected with the function of reproduction, and its occurrence is not necessary to life. If then the uterine mucosa be not analogous to other mucous membranes, we must be cautious in transferring to the etiology of its diseases notions gained from the study of pathological processes in these others. Thus we are prepared for the modern view that many of the processes which we have to describe under endometritis are more allied to new formation than to inflammation; or, at any rate, to the inflammation we are accustomed to study in mucous membranes elsewhere. Were we to subject the heterogeneous mass of pathological conditions grouped under endometritis to exact criticism, much would disappear and the residuum would be small. Thus endometritis fungosa is more of the nature of a new growth than of an inflammatory process; the glandular form of endometritis is more akin to an adenoma than to a catarrh of a mucous membrane; and many cases of endometritis after abortion should, according to Küstner, be considered as deciduoma.

Pozzi, however, in his admirable chapter on Metritis in his treatise on Gynæcology, justifies the grouping of these varied conditions under Metritis, because they have these features in common—that their commencement is an infective process, and their evolution defensive and limiting in its action. This, however, does not exhaust the features of an inflammation as contrasted with a neoplasm. The final product of an inflammatory process is a degenerated tissue rather than the tissue characteristic of the organ in which it has occurred. Of the former we have illustrations in those forms of endometritis which end in the destruction of the mucosa; of the latter in those which end in hypertrophy.

On the other hand, the uterine mucosa, and especially that of the cervix, is analogous to other mucous membranes in its tendency to be affected in certain diatheses or constitutional states. Thus in tuberculosis, in syphilis, in rheumatism, in gout, in anæmia and chlorosis, there is a tendency to cervical catarrh as there is to bronchial or gastric catarrh.

We are not yet in a position to classify satisfactorily the causes of uterine inflammation. From the bacteriological standpoint they fall into two classes: those in which micro-organisms play a part, and those in which they do not. The former class comprises septic, gonorrhœal, tuberculous, diphtheritic, and probably syphilitic endometritis; the latter includes the various hyperplastic forms. This standpoint does not give an adequate view, because the microbic group constitutes only a small proportion of the conditions which are grouped under endometritis, while the latter includes many characteristic pathological types.

In the present state of our knowledge it is convenient to arrange the causes of uterine inflammation in these two groups—the constitutional and the local.

The general causes of uterine inflammation are even more deserving of study than the local causes. Being less obvious, they do not force themselves upon our attention; more subtle in their action, they are more difficult to estimate; and the more their constitutional quality, the more difficult they may be to treat. In scrofula and tuberculosis there is a tendency to uterine catarrh, affecting specially the cervix; as there is a tendency in the same diathesis to bronchial or gastric catarrh. So also in patients suffering from rheumatism or gout, we find a similar tendency, and likewise in girls suffering from anæmia or chlorosis. Apart, indeed, from any special diathesis, a generally enfeebled state of the constitution will bring out a tendency to cervical catarrh, as it may to tonsillitis. Hence the gynæcologist must direct his attention to those modes of life which tend to undermine the health. Once we fully appreciate the connection between the general health and local conditions, we shall make out a strong case against the current mode of bringing up young girls, especially during the years of school education. The present system undoubtedly favours menstrual disturbances which frequently end in uterine inflammation (*vide* pp. 118-125).

Passing from constitutional proclivities to specific diseases, we find that the uterine mucosa, like other mucous membranes, is affected in the course of the exanthemata. Thus in measles, scarlatina, small-pox, typhoid fever, and cholera, endometritis is liable to occur. In influenza epidemics menorrhagia was a not infrequent symptom. Gottschalk found hæmorrhages in the uterine mucosa in influenza, but no microbes. Organic diseases which favour passive congestion also lead to inflammatory changes in the uterus. Thus in diseases of the heart and kidney, and especially of the liver, uterine inflammation may be present, and can be dealt with only by recognising and treating the primary affection.

Inflammation of adjacent organs produces changes in the uterus, apart from simple extension of inflammation. These occur in inflammation of the uterine appendages, and especially of the ovaries. Czempin, who studied this point in patients in Dr. Martin's clinique in Berlin, mentions four kinds of such causes: inflammation of the ovaries with or without that of the tubes; old parametritis which has become acute; irritation of the peritoneum, as in cicatrices after Tait's operation and ovariotomy; and other slowly progressing conditions of the appendages, such as pyosalpinx and sarcoma of the ovary. Should an etiological relationship be established between disease of the appendages and uterine inflammation, it will furnish additional reason for the removal of these organs when diseased.

Irritation of the rectum also keeps up uterine inflammation, which has been known to disappear on removal of a rectal polypus.

Passing now to the local causes, we note the danger of exposure to cold or great fatigue at the menstrual period. If a woman take a chill during menstruation its effects will probably appear in the pelvic organs. And independently of undue exposure, the congestion of the menstrual periods plays a very important part in the exacerbations of uterine inflammation.

The ovaries play a special part in the development of endometritis. Brennecke, who has drawn attention especially to this point, makes one group of cases of endometritis fungosa arise under their influence. These cases are characterised at the outset by amenorrhœa for one or two periods. This he explains by the ovarian stimulus, which, while exciting the hypertrophy of the mucosa which precedes normal menstruation, is insufficient to cause hæmorrhage. Thus arises a hyperplasia of the mucous membrane from which hæmorrhages afterwards occur. I have not seen any cases of endometritis beginning with pathological amenorrhœa, such as Brennecke describes, but have always been able to account for the amenorrhœa by an early abortion. On the other hand, the irregular bleedings at puberty point to a tendency to endometritic changes in connection with the initiation of the functions of the ovaries.

Pelvic congestion, due to excessive sexual intercourse or to masturbation, is also given as a cause of uterine inflammation. In prostitutes cervical catarrh is common, but this is probably the result of gonorrhœal infection.

Septic infection occurs usually in connection with the puerperal state, whether after abortion or labour. In this state we have a combination of circumstances favourable to septic infection; namely, raw surfaces, dead matter liable to decompose, and low vitality of the tissues. It is, therefore, in the puerperal state that we find the best examples of acute metritis, and in connection with it the pathology of the malady has been chiefly studied. Hence acute metritis as described in the text-books concerns the obstetrician rather than the gynæcologist. The pathology of the chronic forms of uterine inflammation which come under the attention of the gynæcologist is being worked out but slowly; they are, however, likewise septic in origin. This is a fact which cannot be too much insisted on, as it gives the reasons of the treatment, which is here preventive, and consists in carrying out thorough cleanliness with antisepsis in all gynæcological work. The activity of germs depends in part upon the media in which they are cultivated. Some that have lost their virulence regain it in a favourable soil. And the post-partum uterus is practically an incubator, at a suitable temperature for their development, containing the necessary pabulum in the form of retained decidua or blood-clot; we can therefore understand how the microbes may multiply there and become virulent. Abortion, even more frequently than full-time labour, is the starting-point of uterine inflammation, owing in part to the greater tendency to retention of portions of the ovum, and in part to patients taking less care of themselves after abortion. Lacerations of the cervix [see "Morbid Conditions of the Female Genital Organs resulting from Parturition," p. 712], which occur in abortion as in labour, form channels for septic absorption and consequent cervical catarrh; and in a large proportion of cases we may trace the inflammation back to such causes. The interior of the uterus after delivery is also practically a large raw surface; hence endometritis in multiparæ can often be traced back to the puerperium. The term subinvolution, introduced by Sir James Simpson, covers all the changes in the cervix, the endometrium, and the body of the uterus thus produced during this period.

Besides acting as foci for the production of septic material, portions of retained decidua occasionally cause endometritis by maintaining their vitality instead of breaking down in the lochia. In such cases islets of decidual cells have been described in the inflamed endometrium. We have thus a form of endometritis after abortion which is a new formation rather than an inflammation, and can be treated only by the curette.

The introduction of septic matter by the gynæcologist in his use of septic sounds or tents, or the neglect of antiseptics in operations, need only be mentioned as sources of uterine inflammation which should not exist, and which are becoming rarer now the importance of antiseptics is generally recognised.

If in fertile women puerperal sepsis is the most important cause of uterine inflammation, in sterile women the ravages of the gonococcus are deserving of careful study. While those who have written on gonorrhœa certainly convey the impression of exaggerating its frequency, it is nevertheless a malady which, in its subtle invasion and its far-reaching effects, requires careful investigation (*vide* p. 552). Of these effects sterility is of some importance. When patients seek advice, many years after marriage, on account of barrenness, persistent leucorrhœa, menorrhagia, and dysmenorrhœa, symptoms all dating from the time of marriage, the possibility of gonorrhœal infection must be kept in mind. Here also we note the importance of the etiological standpoint; for if we can be sure of the cause, the whole case, as regards both diagnosis and treatment, assumes a different complexion.

Uterine inflammation as the result of displacements is of interest, as it gives us the clue to the difference in the opinions of gynæcologists concerning the significance of these lesions. Where retroversion has not interfered with the involution of the uterus during the puerperium the displacement is symptomless; but if endometritis and chronic metritis be present, we have then symptoms due to these pathological conditions. Chronic metritis and endometritis are by no means such invariable accompaniments of retroversion as they are of prolapse, in which there is always some hypertrophy due to their presence. For the full discussion of the relation of displacement to inflammatory conditions, see the chapter on "Displacements of the Uterus" (p. 177).

Chronic metritis and endometritis also accompany fibroid tumours of the uterus and mucous polypi, as described in the chapter on "Benign Growths of the Uterus" (p. 267).

We pass now to the various forms of inflammation, dividing them, according to the seat of the lesion, into (A) Cervical catarrh; (B) Endometritis; and (C) Metritis. There are other conditions which do not fall under these heads, such as tuberculous inflammation of the uterus, senile endometritis, and pyometra. These will be considered separately at the end of this article.

The cervix is sufficiently distinct from the body of the uterus to justify its being treated separately. Structurally, it is quite different from the latter: on its vaginal aspect it is covered with squamous epithelium resting on papillæ of connective tissue, and without mucous follicles; its canal is lined with a single layer of cubical epithelium so folded as to form shallow recesses with racemose mucous glands; its mucous surface differs, therefore, from that lining the body of the uterus. Its muscular tissue is not arranged in layers, but consists of fibres scattered irregularly through the connective tissue which preponderates.

Functionally, it differs from the body in that it plays a passive part in menstruation and pregnancy. Pathologically, it differs in that the tumours which are common in it are rare in the body of the uterus, and conversely. We are therefore prepared to see that chronic inflammation of the cervix may not spread to the body of the uterus. Though clinically we frequently find cervicitis accompanied by inflammation of the body, yet, as this association does not by any means invariably occur, we are warranted in considering the cervix by itself.

An anatomical and pathological basis for classification of the various forms of uterine inflammation is preferable to a purely clinical one. As an illustration of the latter, we have Pozzi's classification according to "the dominant clinical characteristic." He thus describes (i.) Acute inflammatory metritis; (ii.) Hæmorrhagic metritis; (iii.) Catarrhal metritis; (iv.) Chronic painful metritis. While agreeing with all that he says as to the artificial nature of the various classifications of varieties of uterine inflammation, and agreeing with him also on the importance of the clinical standpoint, we question whether merely to select a prominent symptom as the basis of classification is an advance in our method of classification. Though much may be said in its favour, it is practically a return to the symptomatological standpoint.

A. CHRONIC CERVICAL CATARRH.—Acute cervical catarrh can seldom be studied as a separate condition. It occurs as part of the general inflammation of the uterus seen in puerperal sepsis, and is often the initial stage of the chronic affection, from which, however, it is not marked off.

Chronic cervical catarrh is one of the most important conditions which the gynæcologist has to treat. Matthews Duncan said that, according to its gravity, it would not be placed higher than the third rank; but that on account of its frequency it ranks with chronic ovaritis and chronic inflammation of the uterus.

Clinical History and Symptoms.—The patient, usually a multipara, comes complaining of a weak back and "whites." The pain is generally found to be in the sacral region, the seat of sympathetic pain for the cervix; sometimes it is a sense of dragging or bearing down on the pelvis.

The white discharge may simply be an exaggeration of the normal secretion of the cervix, which is viscid and opalescent, or it may be yellow and purulent. In the former case it is difficult to draw the line between the normal and the morbid, as many women normally have a certain amount of leucorrhœal discharge, especially after the menstrual period. The discharge may have lasted some time, unless suddenness of onset with urinary symptoms, which is often suggestive of a gonorrhœal origin, lead her to seek advice at once. The most striking feature of cervical catarrh is its chronic character: the condition is one which sometimes lasts for years. The patient may show one of the constitutional conditions referred to under etiology, such as anæmia or the gouty diathesis; and the more remote causes leading to the congestion of the uterus, as of other organs, should always be inquired into. The symptoms will most frequently be traced back to childbirth or abortion, sometimes to exposure to cold or undue fatigue at a menstrual period, or to the commencement of gonorrhœal infection. In acute cases urinary complications are often present. Menstruation is sometimes profuse and painful, which is probably due to accompanying endometritis—just as the pain in sexual intercourse, which is sometimes complained of, may be explained by associated parametritis; the cervix uteri itself is not sensitive. If the condition have persisted for a long time, symptoms of general weakness come on; the patient complains of lack of energy and of being easily tired, and she may have a poor appetite and slow digestion. Sterility, also, is present in some cases, although it is difficult to say whether this is due to a plug of mucus in the cervix or to some affection of the mucous membrane higher up in the genital tract. The explanation of the sterility is more probably vital than mechanical, as the discharge affects the vitality of the spermatozoa.

Pathology in relation to Physical Signs. — Pathology renders a peculiar service to the clinician in giving him a basis for physical diagnosis. It accounts for appearances which he has noticed clinically. The study of disease is the study of a life-history. At each successive stage in its progress the pathologist steps in and gives a physical basis for each sign and symptom. He clears away the crumbling remnants of a broken-down hypothesis, and enables the clinician to put his foot down on the rock of anatomical fact. We consider pathology, therefore, in its relation to physical signs.

Nowhere has this service of pathology been more strikingly illustrated than in the physical diagnosis of cervical catarrh. The use of the speculum to determine the source of the discharge shows a red granular surface round the os externum, which bleeds easily. Though more difficult to use, Sims' speculum is superior to either the bivalve or tubular one, because it disturbs less the normal condition of the parts, and enables us to judge of the presence of laceration and the amount of ectropion.

The surface looks like an ulcer, because it is red, granular, and bleeds; and looking like an ulcer it was called an ulcer, and treated by surgical methods as ulceration. Notions derived from ulceration of the skin were imported into the region round the os; and herpes, pemphigus, varicose ulcers, and cockscomb granulations were described. The condition round the os was dissociated from the catarrhal inflammation within the canal, or was regarded as secondary to it, the irritating leucorrhœa causing destruction of tissue. The word ulceration not only suggested a wrong treatment, but gave the condition an undue importance in the mind of the patient.

All this was changed by the microscopic work of Ruge and Veit, who showed that the apparently raw surface is covered with epithelium, and that the granular points are new formations which have no relation to the granulations of an ulcer. The microscopic characters of the mucous membrane, to be readily understood from Fig. 67, which represents a clipping from one of these catarrhal patches, are as follow. The surface is covered with a single layer of epithelium; the cells are smaller than those which line the normal cervical canal, and, being narrow and long, have a palisade-like arrangement. The thin layer of cells allows the subjacent vascular tissue to shine through, hence the red appearance of the surface. The surface is moreover thrown into numerous folds producing glandular recesses and processes. These processes cause the granular appearance of the surface. If the recesses be long and narrow the surface is split up into distinct papillæ. This constitutes the papillary erosion. If the ducts of the glandular recesses become obliterated, the secretion distends the glands below and produces retention-cysts; these increase in size, and may come to the surface and burst, producing the follicular erosion.

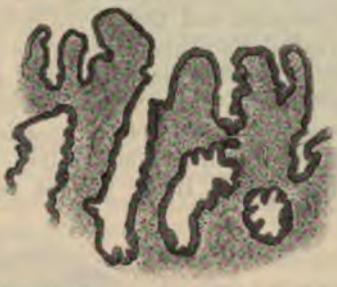


FIG. 67.—Section of a catarrhal patch (so-called ulcer) on the vaginal aspect of the cervix. The free surface is covered with a single layer of columnar epithelium. It is folded into papillary elevations. Below the surface are gland-spaces cut across, which may become dilated so as to form retention-cysts.

The section given at Fig. 68 passes through one lip of the cervix in the region of the os externum. In the upper portion are seen glands of the cervical canal cut across. Lower down to the left are seen the many layers of squamous epithelium which mark the vaginal aspect of the

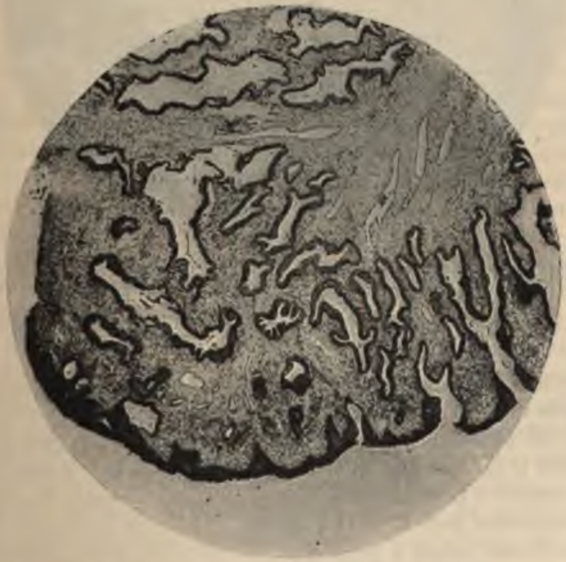


FIG. 68.—Section of cervix from a case of cervical catarrh (20 diameters). The vaginal aspect of the cervix is in the lower part of the section, and shows to the right a catarrhal patch.

cervix, while to the right this epithelium has been shed in parts, and the surface has been thrown into papillæ covered with cylindrical epithelium similar to that seen in Fig. 67. Should the ducts of the glands become obliterated, and the cavity below distended with inspissated mucus, the so called Nabothian follicles are formed. These are felt as small shot-like bodies beneath the mucosa, and may come to lie underneath the squamous epithelium of the vaginal aspect of the cervix. This may be either because the ends of the glands were originally there, or they may be produced during the healing of an erosion, of which Fig. 69 is an illustration. In it we see the dilated cavity lined with glandular epithelium, and the duct of the gland can be traced into the squamous epithelium. Compare also Fig. 67.

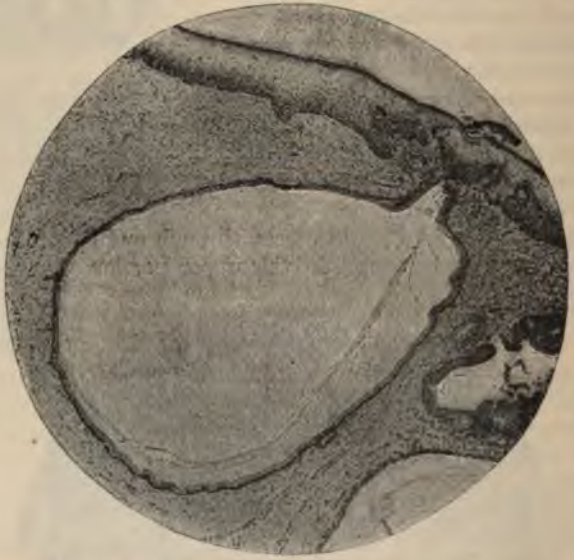


FIG. 69.—Section through vaginal aspect of cervix, showing dilated cervical gland (40 diameters).

The raw-looking surface is therefore a newly-formed glandular secreting surface, which in structure resembles the cervical mucous membrane. This addition to the extent of secreting surface increases the leucorrhœal discharge, which is the leading symptom. The so-called ulceration is thus seen to be simply a part of the process of cervical catarrh, and this not the most important part. If the cervix has been lacerated, the swollen mucous membrane causes a gaping of the cervical canal at the cleft; and thus we may be misled as to the extent to which the catarrhal patches spread beyond the os externum. By rolling in the everted lips with the tenacula until the laceration closes, we can estimate the probable position of the os externum.

From this it is evident that the process is not one of ulceration, and the term should be abandoned. The German term "erosion" is open to similar objections. "Ectropion" or "eversion" of the mucous membrane describes the condition in its relation to laceration, but does not describe the extension of the secreting surface beyond the os externum. Probably the best name for these red patches lying outside the os externum is "catarrhal patches," as it suggests that they are portions of the mucous membrane in the same catarrhal condition as that lining the cervical canal.

Fischel and other observers have confirmed these observations of Ruge and Veit in their essential points. Fischel considers, however, that the secreting processes, though new formations, have the structure of papillæ, and are not mere foldings of the mucous membrane.

While there is, therefore, no disagreement as to the microscopic appearance of the so-called "ulcerations," the origin of this new epithelial structure is disputed. Ruge and Veit hold that this single layer of small cylindrical cells is produced by proliferation of the cells of the deepest layer of the rete Malpighii, while those of the superficial layer are shelled off. It will be observed also that they regard the simple follicular and papillary "ulcerations" as the results of one and the same process, namely, proliferation of epithelial cells. On the other hand, those red patches are generally continuous with the mucous membrane of the cervical canal, and resemble it in their microscopic structure. It is therefore much more probable that they are occasioned by proliferation of the epithelium which lines the cervical glands, leading to an extension of the glandular surface beyond the os externum. Fischel holds that there is not only a proliferation of epithelial cells, but of connective tissue also, and that as the one or the other preponderates the follicular or papillary forms are produced. He also thinks that erosions are due to the persistence of the cylindrical epithelium (found outside the os externum in the fœtus) into adult life, and to the desquamation of the squamous epithelium which had come to cover it.

The question of the origin of the cylindrical epithelium found in erosions is rendered more difficult by the observation that the boundary-line between the squamous epithelium outside the cervical canal and the cylindrical within it varies at different periods of development and in different individuals. In the fœtus, according to Ruge's investigations, the cylindrical epithelium extends beyond the os externum; and we have a hint of the persistence of this fœtal condition in the congenital ectropion described by Fischel. Klotz describes two types of cervix distinguished by the distribution of the squamous epithelium: one, cavernous in texture, and having the squamous epithelium extending some distance into the cervix; the other, glandular in its substance, and having the squamous epithelium stopping at the usual seat of the os externum.

The foregoing description is based on what is found in multiparous patients, in whom the cervical changes, as seen through the speculum, are obvious. In nulliparous patients cervical catarrh may manifest itself by catarrhal patches beyond the os externum, but more frequently the vaginal aspect of the cervix, though soft and swollen, looks healthy. The mucous membrane within the canal, however, is in a similar condition to that described above. The os is sometimes unusually small, and the cervical canal becomes distended with the secretion.

The Diagnosis of cervical catarrh is comparatively easy, the cervix being accessible to examination. The condition found on vaginal examination varies as the patient is a nullipara or a multipara. In the former case the cervix feels enlarged and softened, and when there is extension of the catarrhal area beyond the os externum the margins of the os are soft and velvety. In a multipara the os will probably be notched by old lacerations, and may be so patent that the tip of the finger can be passed into the cervical canal. The area round the os is soft and velvety, or rough and granular; and when the Nabothian follicles have been converted into retention-cysts, these are felt as small nodules, like peas or shot, in the mucous membrane. Polypoidal projections may be present, and, more rarely, the whole cervix is converted into a cystic mass. The speculum can now be used to confirm what the fingers have felt, and is absolutely necessary in training the finger to recognise the various conditions present. The extent of catarrhal area, the amount of eversion, and the appearances corresponding to the velvety, granular, and nodular feelings are demonstrated by it. But once the finger has been educated, the speculum, for diagnosis at any rate, comes to be less and less used. When it is desirable to determine the extent of lacerations with a view to operative procedure, tenacula are useful to roll in the everted lips of the cervix. The sound is only of service in diagnosing catarrh in nulliparæ, where it may show a cervical canal unusually dilated by accumulated secretion.

Under *differential* diagnosis we have only to consider the diagnosis of cervical from vaginal or uterine leucorrhœa, and of simple induration of the cervix from syphilitic ulceration and commencing malignant disease.

The normal secretion from the glands of the cervical canal is clear and viscid, resembling unboiled white of egg; and it is alkaline in reaction. It may be of an opaque white due to an escape of mucous corpuscles, or yellow when pus corpuscles are present. Frequently it is tinged with blood. In the worst cases of catarrh the discharge is a thin yellow or greenish pus. The diagnosis of cervical from vaginal leucorrhœa is made by the speculum, for in the former case we see the leucorrhœa, with the characters above mentioned, coming from the cervix; or by Schultze's method of placing a tampon at the os externum to catch the cervical secretion. The diagnosis of cervical from uterine leucorrhœa is more difficult. Menorrhagia, with increase in the length of the uterine cavity and irregularities in its mucous membrane, point to the presence of endometritis.

Syphilitic ulceration of the cervix is extremely rare, and the history with the indications of syphilis in other parts makes diagnosis easy. On the other hand, the diagnosis from commencing malignant disease is exceedingly difficult. If we are dealing with a case of advanced carcinoma, in which ulceration has occurred, there is no difficulty; the finger at once recognises the friable bleeding surface with firmer margins, and the infiltration of the cellular tissue causing fixation. If, however, the cervix be simply nodular, and ulceration has not occurred, it may be impossible to say at this stage whether the case be one of cancer or not. Bennet pointed out that the lobulation of the cervix in chronic inflammation is more regular, the furrows radiating from the cervical canal being in fact old lacerations, while in cancer the lobulations are irregular. According to Spiegelberg, when a tent is placed in a cervix affected with malignant disease the infiltrated parts do not dilate like normal tissue. This subject belongs, however, to the diagnosis of commencing cancer, for which the chapter of this work on "Malignant Growths of the Uterus" must be consulted (*vide* p. 318).

Treatment.—The importance of constitutional treatment must be fully recognised, as there is no doubt that far too much attention has been given to local treatment. In most essays on the treatment of cervical catarrh we find pages given to local applications and to operative procedure, while general treatment is dismissed in a paragraph. This makes the local, as against the general treatment, bulk far too largely in the mind of the practitioner. While, on the one hand, it may be argued that there will always be a class of patients who are not satisfied unless something is being done directly for them, we must remember that, on the other hand, irreparable harm often results from lines of treatment which direct the patient's attention to the pelvic organs.

The care of the patient's general health is to be put in the forefront. Change of air, light nourishing food, and a certain amount of exercise, are beneficial; and cold hip-baths in the morning are of service. Disturbances of the digestive system, which are frequent in chronic cases, must be carefully treated. Where rest from sexual activity is desirable, this is often secured by recommending that the patient leave home for a time. Tonics, such as arsenic, quinine, and iron, are useful.

The diathesis should also be carefully studied. In strumous or gouty patients, for example, cervical catarrh is simply one of many manifestations of the constitutional state, and is only of significance as directing our attention to it.

Of local applications the most important is the vaginal douche. This treatment, as well as the mode of applying various therapeutic agents to the uterus, is described in the chapter on "Gynæcological Therapeutics" (p. 737); so that here mention need be made only of special points bearing on their use in uterine inflammation. The douche, to be effective, should be given by means of a douche-can, and consist of not less than a quart of water. The patient should be semi-recumbent. The temperature of the water must be adapted to the individual case: if pain or hæmorrhage be present, the hot douche is preferable. The douche is given for cleanliness, and for the application of antiseptics and astringents. Corrosive sublimate (1 to 4000) is very useful in chronic catarrh, especially if a gonorrhœal or septic taint be suspected. Sulphate of zinc (1 dr. to a pint), sulphate of alumina or sulphate of copper (2 drs. to a pint), are also beneficial. T action of these on the catarrhal patches has been specially investigated Hofmeier, who found that the pale, squamous epithelium gradually cre in tongue-like processes over the red patch. Fig. 70 shows how the sup ficial glands become filled up with squamous epithelial cells. The dee glands have their ducts narrowed or even plugged while the gland cav persists below. Küstner found similar changes produced by antisep douches.

Medicaments may also be applied on vaginal tampons, the b excipient being glycerine. The glycerine itself acts by withdraw serum from the engorged tissue. To it may be added boric acid (50 cent), tannin (1 dr. to 1 oz.), ichthyol (10 per cent), and iodoform.

Applications may also be made on forceps dressed with cot

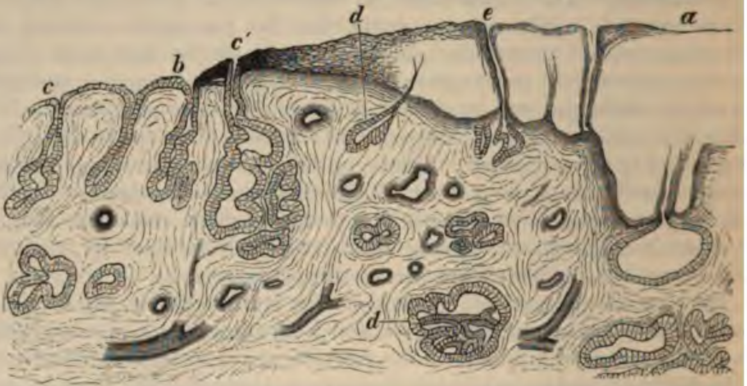


FIG. 70.—Healing of a catarrhal patch treated by astringent or antiseptic injections (Hofmeier). F *c* to *b* is seen part of a catarrhal patch (compare Fig. 67) which from *b* to *a* has become covered with newly-formed squamous epithelium; *dd*, glands whose ducts have been obliterated; *e*, g duct which has persisted.

wadding, dry wadding being used first to swab off the mucus. Churc used a preparation of iodine consisting of 75 grains of iodine and 90 potassium iodide in 1 ounce of alcohol. Weak solutions of nitrate silver are also beneficial.

Where the cervix is much indurated and studded with retention-cy scarification is very useful; it acts by depletion, and also by letting the inspissated mucus. Bleeding by scarification has largely taken place of leeching. Various scarificators have been devised, but ordinary bistoury does perfectly. A tepid douche given afterwa promotes bleeding. Scarification is preferable to the actual caut which has been recommended by Prochownik, as the latter is follo by cicatrisation. In very chronic cases the only remedy is to dest the diseased glands, as we excise the tonsils in tonsillitis: this is d by caustics, the curette, or the knife. Of caustics, potassa-fusa recommended by Sir James Simpson, and the zinc-alum sticks of Sk berg by Matthews Duncan. This use of caustic must be distinguished from the application of it to touch the so-called ulcer so as to make it heal, and has many advocates. It is better to use the curette, as recommended by Thomas, or the knife as in Schroeder's operation. In fact, where the glandular tissue has to be destroyed, the most efficient and cleanest way of doing it is by excision of the mucous membrane; although the cases in which this operation is called for are comparatively rare. In Schroeder's operation the cervix is laid hold of by two volsellæ, one on each lip, and drawn downwards. It is then divided laterally, as far as the fornix, with the scissors, so as to form an anterior and posterior lip which are separated as far as the vaginal roof. A transverse incision (seen in section at *a*, in Fig. 71) is made across the base of the anterior lip dividing the whole thickness of cervical mucous membrane. The point of the lip is next pierced at *c*, and the knife pushed in the direction *bb* till it reaches the cross incision *a*; the blade is then carried outwards, first to the one side and then to the other, so that all outside of the line *a*, *b*, *c* is removed. The flap of the cervix is now turned in and stitched (Fig. 72), and the angles of the wound in the fornix closed.

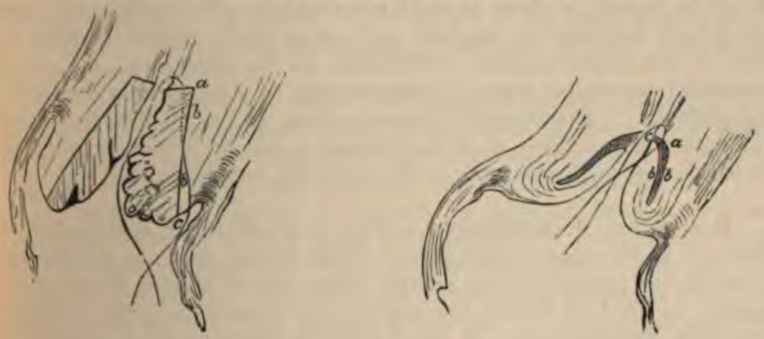


Fig. 71. Fig. 72.

Schroeder's operation for excision of the cervical mucous membrane in cervical catarrh. Fig. 71, line of incision in mucous membrane; Fig. 72, mucous membrane excised, and flap *bc* turned in on *ab*.

Emmet's operation is also useful in cases of deep laceration, especially where there is cicatricial tissue at the base of the cleft (*vide* p. 836): it has not fulfilled all that was expected of it, however, and it is not performed nearly so frequently as was the case some years ago. It simply conceals, without removing, the diseased mucous membrane, and should always be combined with measures directed to the treatment of the catarrh.

For well-marked hypertrophy of the substance of the cervix amputation is the only treatment.

In the cervical catarrh of nulliparæ, where there is a narrow os externum, the bilateral division of the cervix is of service. It allows the secretion to escape instead of accumulating; and applications can be made to the cervical canal. It is also said to favour the occurrence of conception.

This operation is described in the chapter on "Minor Uterine Operations," p. 784.

ACUTE METRITIS AND ENDOMETRITIS.—In the acute condition we cannot separate these two affections. Clinically they are met with in the puerperal state, and as exacerbations of the chronic condition to be described presently. Except in the puerperal state they are never fatal, hence the classical descriptions which are handed from text-book to text-book belong to a treatise on puerperal fever rather than to a system of gynæcology.

Wyder, from a study of the membrane exfoliated in cases of membranous dysmenorrhœa, has recently described the pathological changes which he regards as those of acute endometritis. The cells in the stroma are greatly increased in numbers, and are so closely packed together that little of the matrix is seen. Gottschalk, on the other hand, finds in the exfoliated membrane changes characteristic of a hæmorrhagic interstitial endometritis. Membranous dysmenorrhœa, or, as it has been called, exfoliative endometritis, is a rare affection, and its pathology can hardly be considered to be the same as that of acute endometritis.

B. CHRONIC ENDOMETRITIS.—This is a sufficiently well-marked condition to merit separate treatment. I would limit the term to those cases in which the patient has the general symptoms of chronic uterine inflammation, which I shall describe under chronic metritis, with in addition increased discharge either of blood at the menstrual period, or of leucorrhœa in the intervals. As the presence of either of these symptoms points to changes in the uterine mucosa as the more prominent condition, there is sufficient reason for treating chronic endometritis as a condition distinct from chronic metritis.

Clinical History and Symptoms.—The history may be traced back to abortion or labour, to an attack of uterine inflammation as the result of chill, or to gonorrhœal infection. In a considerable number of cases, however, the symptoms begin insidiously, and develop gradually without any assignable cause. Endometritis is more frequent in multiparous patients, and more common later than earlier in life; though it also occurs in nulliparæ, especially where there is stenosis of the os externum. Ruge describes one-half of his cases as occurring about forty years of age. After the menopause a senile form of endometritis may appear, which has to do with the retrogressive changes taking place at that time in the uterus (see p. 263).

The symptoms characteristic of endometritis are leucorrhœa and menorrhagia. The secretion from the body of the uterus is less viscid than that from the cervix, and may be clear; but more frequently it is muco-purulent. It may be tinged with blood, so that the patient believes herself to be more or less continually unwell. Sometimes it comes away more freely than at others, as if it collected in the uterus, or as if there were hypersecretion at intervals. It may be so irritating as to excoriate the vulva

Menorrhagia is generally present, but not always. In some cases the loss may be so considerable as to suggest malignant disease, and even to endanger the patient's life by profound anæmia.

Of the exact relation of these symptoms to the anatomical changes to be immediately described, we do not yet know enough to make definite statements. Olshausen, who first described endometritis fungosa—a state in which the changes are interstitial—drew attention to hæmorrhage as the prominent symptom in these latter cases. Wyder also, who has studied the mucous membrane changes found with fibroid tumours, maintains that bleeding occurs in interstitial, but not in glandular endometritis. On the other hand, Veit holds that bleeding may occur with either variety. Whatever be the reason of the hæmorrhage, this is the symptom which most immediately affects the patient's health, and calls for prompt treatment.

Pain at the menstrual period is sometimes present, although it is less frequent in endometritis than in inflammation of the uterine appendages. It is, of course, characteristic of the exfoliative form. The weak back and other pains will be considered under chronic metritis.

The reproductive function is liable to be affected, although it is surprising how many patients show all the symptoms of endometritis in the intervals between conception. Sterility is occasionally found, but it is difficult to say whether it be not due to associated inflammation of the uterine appendages, as undoubtedly is the case in gonorrhœal affection. Definite information as to the effect of uterine secretions on the vitality of the spermatozoa is wanted. Cases in which conception after a period of sterility follows shortly on curetting, suggest that the diseased mucosa in some way prevents conception. Abortion is undoubtedly often due to the morbid condition of the mucous membrane, which leads to hæmorrhages into it, and to bad implantation or death of the ovum.

Pathology in relation to Physical Signs.—Pathology has here rendered service by explaining the conditions found by the sound and curette, the two instruments usually employed in the recognition of endometritis.

The only changes in the uterus are the increase in the size of its cavity, and the swollen and soft condition of the mucous membrane. The latter, moreover, is sometimes thrown into rough projections, and is also so congested that it bleeds easily. All of these features are recognisable by careful use of the sound. In fact, it is for the exploration of the mucosa rather than for determining the position of the uterus, that we find the sound of service; it shows that the cavity of the uterus is always enlarged in cases of endometritis. Rough granulations can be detected by holding the handle delicately; and even the peculiar soft character of the thickened membrane may be thus recognised. If bleeding occurs after its use, congestion of the mucosa exists. It is also said that its introduction is accompanied with pain, and that areas painful to touch can be made out over the fundus (Routh), or in other parts of the uterus (Veit). It is extremely difficult, however, to exclude peritonitic or cellulitic conditions, which would also cause pain from the movement given to the uterus as the sound is introduced.

The hypertrophied mucosa can be easily scraped away by the curette, and its microscopic examination by the pathologist has done much to clear up our conception of endometritis, although much has yet to be learned.

Here we consider only the pathology of the hyperplastic forms of endometritis. The pathology of those forms in which micro-organisms play a part will be considered later.

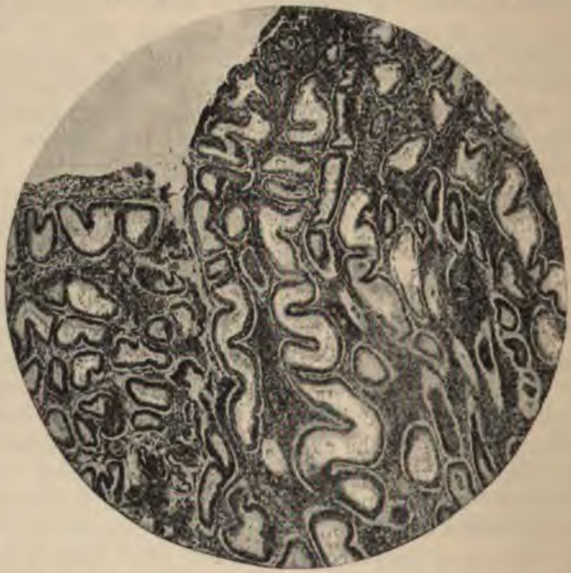
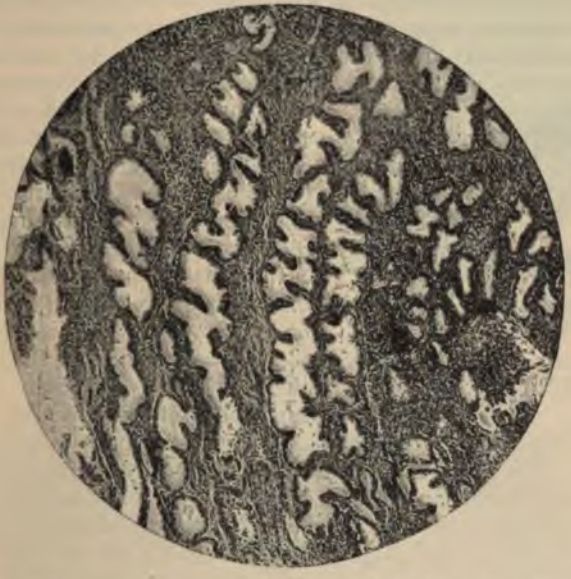


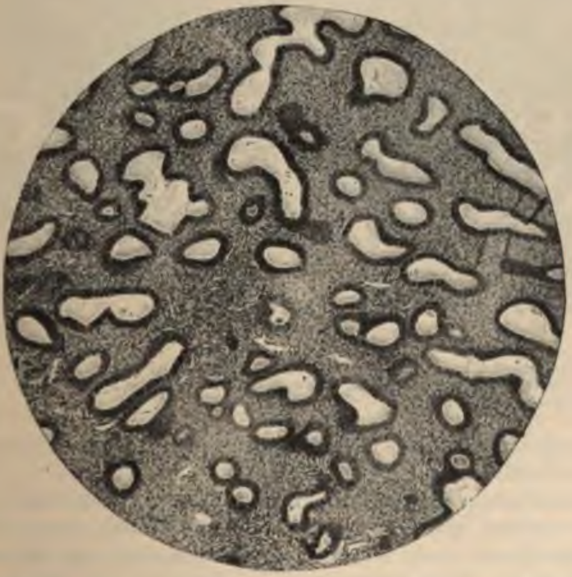
FIG. 73.—Section of tissue removed by curette from a case of glandular endometritis (40 diameters).

In some cases the glands are increased in number. Fig. 73 shows a section of tissue removed by the curette from a case of the glandular type of endometritis. The number of sections of glands in the field of the microscope is much greater than in the case of normal mucosa; and they are not only closer together, but more tortuous. Usually the lining wall of these spaces is even, but occasionally it is folded, as in Fig. 74. This latter appearance has led Ruge to distinguish a hyperplastic variety from the ordinary hypertrophic endometritis.

This hypertrophic form is sometimes seen in cases of fibroid tumour. Fig. 75 is taken from a case in which, with an interstitial fibroid, the mucosa near the opening of the Fallopian tube was hypertrophied so as almost to suggest an adenoma.



74.—Section of tissue removed by curette from a case of glandular endometritis—hyperplastic variety (50 diameters). Note the saw-like appearance of the glands in section.



75.—Section of uterine mucosa from a case of glandular endometritis associated with an interstitial fibroid tumour (40 diameters).

Wyder, who has studied specially the changes in the uterine mucosa in fibroid tumours, says that glandular hypertrophy occurs when the tumour is separated from the mucous membrane by muscular tissue. When a tumour, however, presses on the mucosa so as to affect its circulation, interstitial endometritis appears, and the menorrhagia is due to this.

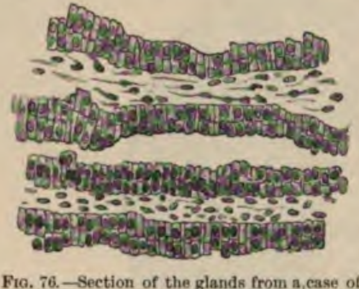


FIG. 76.—Section of the glands from a case of early malignant disease. The epithelium is undergoing multiplication.

It is important to note that the epithelial lining of the hypertrophied gland-spaces is always in one layer. Sometimes an appearance of more than one layer is produced artificially at one point by the direction of the section. If we exclude this, multiplication of the epithelium is always suggestive of commencing malignant disease. The section given at Fig. 76 is of especial interest in this connection. The patient, a nullipara, had for five years suffered from considerable hæmorrhage, and been curetted on different occasions without benefit. On the last occasion a diagnosis of malignant disease was made from the appearance of the section given, and as she declined a radical operation she died within eighteen months from cancer of the body of the uterus.

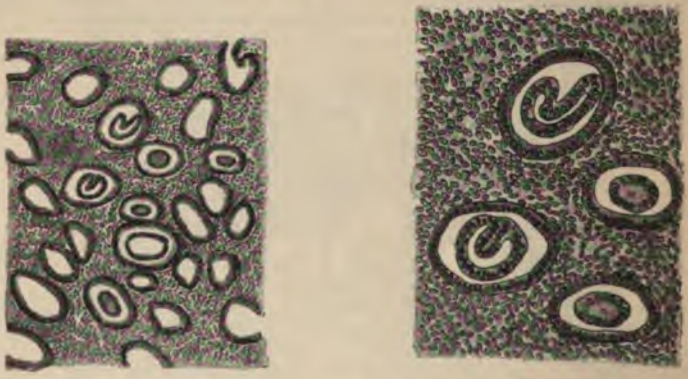


FIG. 77. FIG. 78.

Section of tissue removed by curette from a case of interstitial endometritis. Fig. 77 shows the glands and interglandular tissue under a low power; Fig. 78, the same under a high power, to show the small-celled infiltration.

In another group of cases the mucosa shows interstitial changes, of which the sections given at Figs. 77, 78 are illustrations. The tissue between the gland-spaces is increased in quantity, and shows a small-celled infiltration. The changes in this interstitial endometritis were first described by Olshausen under the term of endometritis fungosa, of which enorrhagia is the chief symptom. He found the mucosa hypertrophied o three or four times its normal thickness, and elevated throughout in a ushion-like swelling, or in discrete spongy masses. The change stops at he os internum, the cervix being unaffected. It is characterised by hypertrophy of the mucosa, with increase of all its elements, moderate ilatation of the uterine glands, enlargement of the blood-vessels, and arked cellular infiltration of the connective tissue."

In yet other cases changes characteristic of the glandular and interstitial forms may be found together. Thus in the section given at ig. 79, while the interstitial changes are the main feature, the two glands seen in section show hyperplastic changes producing a saw-like appearance. Ruge has called this the "mixed" form.

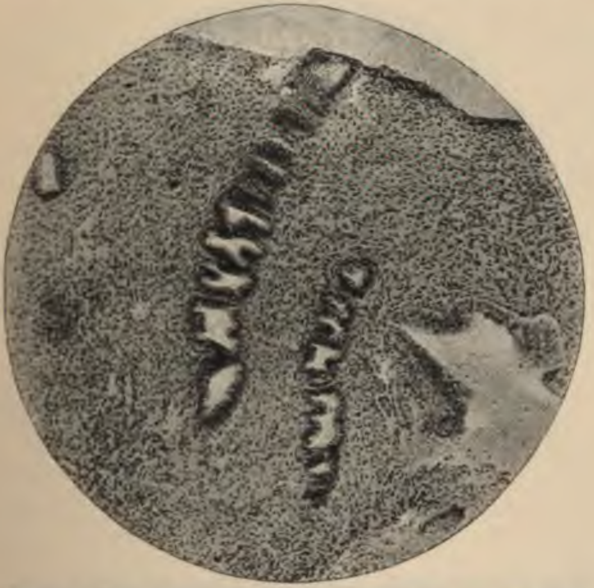


Fig. 79.—Section of tissue removed by curette, showing glandular and interstitial changes (130 diameters).

In some cases of endometritis, squamous epithelium has been found in patches, replacing the normal columnar epithelium of the endometrium. Zeller, who first recorded this condition under the term of psoriasis uterina, described it from three cases post-mortem and sixty-three observations on the living subject. More recent investigations by Pincus, Ruge, and others, have shown that its occurrence, apart from malignant disease, is extremely rare. Several cases of the latter have been recorded, but the subject belongs to cancer of the uterus. A well-authenticated case of its occurrence as a simple condition has been described by von Rosthorn.

Relation of Micro-organisms to Endometritis.—*A priori* we should expect that micro-organisms would be the chief etiological factor in all cases of uterine inflammation; for the genital tract, of all parts of the body, offers the greatest facility for their entrance and growth. From its anatomical position, and the changes that occur in connection with the functions of menstruation, of married life, of childbirth, and the menopause, this is self-evident. A culture taken from the vaginal orifice shows micro-organisms in abundance.

In striking contrast to what we should anticipate is the now well-established fact that the normal genital tract is, above the os externum, germ-free. Proof of this could only be got by examination of the parts removed by abdominal section; and we had to wait for Winter's systematic examination of Fallopian tubes and uteri obtained in this way for the demonstration of this, the most remarkable fact in bacteriology as applied to gynæcology. Winter placed the boundary between the germ-free and the germ-containing portions of the genital tract at the os internum, but the more recent investigations of Stroganoff, Menge, and Walthard show that it is lower down, in the region of the os externum.

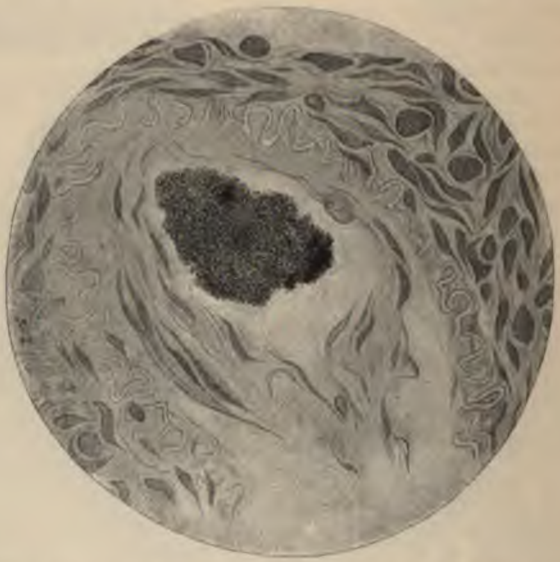


FIG. 80.—Section of uterine wall from a case of septic endometritis, showing plug of streptococci (700 diameters).

When we ask the reason of this remarkable phenomenon we find the answer in the conditions to which micro-organisms introduced into the genital tract are subjected. The secretion present in the healthy vagina has been shown by Döderlein, Menge, Kroenig, and others, to have a germicidal ction. Pure cultures of pathogenic organisms, for example streptococci nd staphylococci, introduced into the healthy vagina are destroyed in a ew hours. The mucus secreted by a healthy cervix has a similar action. Thus the uterus, which would otherwise be the best incubator for micro-rganisms, is barred to their entrance, the bacteriological gate of the enital tract being not at the vaginal orifice, but the os externum.

This, the normal condition of the tract, is interfered with under the ollowing circumstances:—

In the puerperal state we have a complete departure from the normal ondition. The bactericidal secretions are absent, and it is self-evident hat a favourable soil the breaking-down tissues of the placental site, nd the interior of the uterus generally, offer for the growth of micro-rganisms, while the removal of its epithelial covering favours their enetration. It is, therefore, in connection with puerperal inflammation that we have the best opportunity of studying the invasion of strepto-occi; and where general sepsis follows, we find them, not only in the uterus, but in other organs which have become infected from it. Fig. 80 shows a colony of streptococci in a blood-vessel in the uterine wall, while Fig. 81 represents a portion of the kidney from the same case, in which the vessels of the Malpighian tufts are filled with them. In the case from which these preparations were obtained, I found them also in the pelvic cellular tissue and in the heart wall.

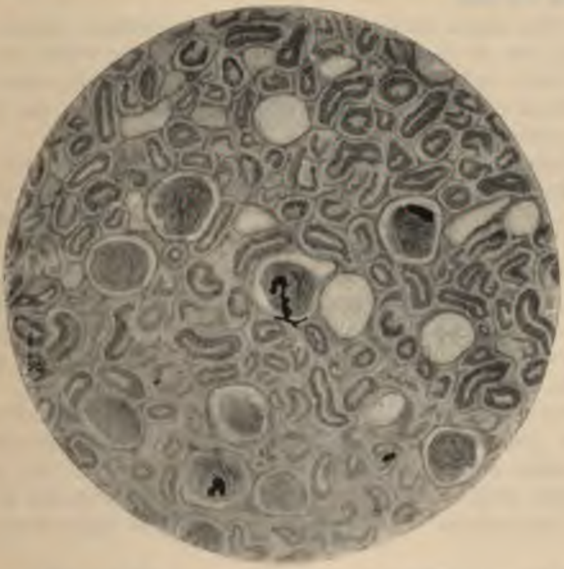


FIG. 81.—Section of kidney from the same case as Fig. 80, showing streptococci in the Malpighian tufts (50 diameters).

Outside the puerperium similar conditions arise, when the uterine mucosa has been artificially lacerated, and pyogenic germs at the same time introduced. This may occur in any intra-uterine operation with unclean instruments, or in the removal of sloughing tumours.

Streptococci are the most frequent agents of infection, especially the streptococcus pyogenes. The so-called diphtheritic membrane often present in such cases is simply a sloughing layer produced by their presence. Staphylococci also occur, and especially the pyogenes aureus; the bacterium coli communis has also been found. Further, in the puerperal condition, and also in the case of sloughing tumours, saprophytic micro-organisms, which have only a facultative pathogenic action, may produce toxines.

Besides the septic and saprophytic forms, certain varieties of endometritis are due to specific micro-organisms, among which are included the gonorrhœal, tuberculous, diphtheritic, and probably the syphilitic. The gonorrhœal variety alone calls for fuller notice here; the tuberculous we shall consider at page 261.

True diphtheritic inflammation is extremely rare, and has only been described in connection with the puerperal condition. Single cases have been reported by Bumm, Nisot, Whitridge Williams, and Haultain, and six by Longyear, in all of which the Klebs-Löffler bacillus was found.

While the demonstration of gonococci in the Fallopian tubes showed that they had traversed the uterus, there was no proof of their actual invasion of the mucosa until Wertheim demonstrated their presence in uteri removed by hysterectomy from patients affected with gonorrhœa. In these he was able to study the changes in the tissues. He found great infiltration of the interglandular tissues with pus and round cells, diffuse or in groups; the glands pushed apart by œdematous swelling, and the surface epithelium destroyed in many places. In addition to these changes, suggestive of acute interstitial endometritis, he found in some cases hyperplasia of the glands. Fig. 82 is taken from one of his specimens.

The septic, gonorrhœal, tuberculous, and diphtheritic varieties of endometritis do not, however, account for one-half of the cases which come under the notice of the gynæcologist. The relation of micro-organisms to the other hyperplastic forms is fully discussed by Döderlein in his article on endometritis in Veit's *Handbuch*. After giving in detail the various arguments for and against, he comes to the conclusion that these forms are "neither dependent on bacteria nor on the products of such."

Diagnosis.—In considering this subject the distinction of the two main groups of cases, those due to micro-organisms and those which are not, becomes significant. While in the former we rely mainly on the history and clinical features, in the latter we depend on the curette and the microscope. The septic and gonorrhœal forms are recognised by the history of exposure to infection and the subsequent course. The microscope is not of service, for it is difficult to be sure that micro-organisms present are from the endometrium; and the anatomical changes which result from their presence show nothing characteristic. On the other hand, diagnosis of the hyperplastic form is impossible without the microscope. Hence the importance of the examination of the tissue removed by the curette. Figs. 73-79 show the microscopic features of the glandular, interstitial, and mixed forms, and Fig. 76 the changes in the epithelium which may be found in commencing malignant disease, the diagnosis of which from endometritis is of the first importance.

Treatment.—The constitutional treatment of endometritis will be discussed under chronic metritis. The local treatment consists in applications made to the uterine mucous membrane, with or without previous curetting. Before having recourse to local applications we should be satisfied of the necessity for them. As in the case of cervical catarrh, local treatment has received undue attention. Vaginal injections, ergotine, and other uterine hæmostatics should always have a fair trial in the first instance.

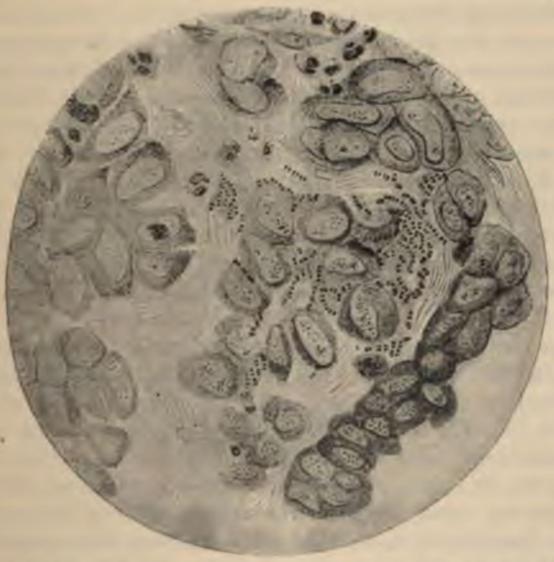


FIG. 82.—Section of uterine wall from a case of gonorrhœal endometritis (Döderlein). Note the gonococci in the substance of the tissue.

Applications are made in the solid or liquid form; the latter, either by means of injection or on a sound dressed with cotton wadding. The technique of intra-uterine medication is fully described in the chapter on Gynæcological Therapeutics. Here we have to consider it only as applied specially to endometritis. With regard to the methods mentioned, I may say that I believe only in the latter method; the introduction of the caustic in solid form, so as to melt inside the uterus, is too indefinite in its action. The use of intra-uterine injections has not found favour in

British gynæcology owing to the dangers connected with it. I do not, of course, refer to the washing out of the uterus with Fritsch's catheter as part of the operation of curetting, but to the injection of caustics by special syringes, such, for example, as Braun's. Lantos' syringe, the point of which is wrapped in cotton wadding, into which the fluid exudes through holes at the side, is a safe instrument; but it does not possess any decided advantage over a dressed sound. I prefer to make applications with the ordinary sound dressed with cotton wadding; the only objection to it being that the fluid may be squeezed out of the wadding as it is carried through the os. This difficulty can be got over by using a thin film of wadding, by making more than one application, and by preliminary dilatation of a narrow cervix. It is always well to use a dry sound first in order to swab away the mucus so as to allow the medicament to act. The applications I prefer are iodine, iodised phenol (consisting of 40 grains iodine in one ounce of carbolic acid), and pure carbolic acid prepared by liquefying the crystals. Formalin has, on account of its germicidal properties, unaccompanied by any danger from absorption, recently been strongly recommended by Menge. It may be applied as a 30 per cent aqueous solution on a dressed probe. Dr. Atthill advocates the use of strong nitric acid, and the preliminary dilatation of the cervix so as to allow of its free application. He uses an intra-uterine speculum of vulcanite to prevent the acid from acting on the cervical canal.

The best results from intra-uterine medication are obtained when it is applied after previous curetting. It is difficult to define the limits of this operation, but it is perfectly safe, and I have never seen any bad results after it. For this very reason it is liable to be abused, and to be performed in cases where it is not called for. That the uterine mucosa can be so easily removed, and is so rapidly regenerated, is no argument for its removal; and the notion of a substitution of new mucosa free from germs, under aseptic conditions maintained for several weeks by the use of intra-uterine injections, is ingenious but open to doubt.

I would limit the operation of curetting to cases in which there is a clear history of recent abortion, in which there is considerable menorrhagia which has not yielded to ergotine, or in which the sound shows the cavity to be distinctly enlarged and roughened with vegetations. It is not called for in cases of catarrhal endometritis, and of course should not be performed when there is acute or subacute inflammation of the uterine adnexa. Curetting for the endometritis of fibroids, and for the diagnosis of malignant disease, does not belong to the subject we are considering. The mode of performing the operation is described on p. 796. After it is done the uterus is to be washed out with a weak antiseptic, and the other applications then made as mentioned above. Where distinct portions of tissue are removed they should be preserved for microscopic examination.

Cauterisation of the mucosa by steam, a method introduced by

Sneguireff, has been recently recommended by Professor A. R. Simpson, who found it useful, especially in checking hæmorrhage (*vide* p. 802).

Electricity has also been used to check the hæmorrhage in endometritis (*vide* p. 807). As it acts simply by cauterisation of the uterine mucosa it does not present any advantages over curetting. It is of service, however, in the endometritis of fibroid tumours, where, in certain cases, it has an effect also on the growth of the tumour.

C. CHRONIC METRITIS.—As in the case of endometritis, I do not consider acute metritis deserving of separate consideration; it appears in most treatises by reason only of the artificial division of affections generally into acute and chronic. The description of its pathology and treatment is taken from cases of puerperal inflammation which do not concern us here. We have good authority for discarding it as a separate affection, when Klob states that he has not met with a single case; Rokitansky, that the uterine tissue is scarcely ever affected primarily; Schroeder, that it is extremely rare; while Thomas regards it as but a complication of endometritis. The late Sir William Priestley's description, in his admirable article in Reynolds' *System of Medicine*, is taken from puerperal sepsis; and in the non-pregnant condition he describes it as occurring chiefly after operations. The use of antiseptics in vaginal operations during the last thirty years, since his article was written, has lessened the frequency of such cases. In the American *System of Gynæcology* Palmer says that pure and uncomplicated metritis rarely if ever occurs. We may note also, in passing, the great rarity of suppuration in the uterine wall; in most of the cases thus described the abscesses were in the cellular tissue beside the uterus.

With regard to the frequency of chronic metritis there is a difference of opinion; but it is largely a question of terms. In the present state of our knowledge we are disposed to regard as chronic metritis all cases of chronic uterine inflammation which do not come distinctly under the category of chronic cervical catarrh or chronic endometritis. In doing this we make chronic metritis one of the most important of the inflammatory conditions of the uterus. It may be argued that our ignorance of its pathology, and the difficulty of exactness in its diagnosis, are not a sufficient reason for making it include a large group of cases of chronic invalidism which cannot be classified under the better known affections. For the present, however, this seems the best course for us to take. Under chronic metritis we include those cases which Sir James Simpson described under subinvolution—a term which, however aptly, only describes the conditions under which chronic metritis most frequently arises.

Clinical History and Symptoms.—No better description could be given of the general features of cases of this class than that of Bennet; although he made the inflammatory condition of the cervix, rather than the accompanying condition of the body of the uterus, the important factor. "To this class belong a large proportion of the population of sofa, bath-chair, nervous, debilitated, dyspeptic females, who wander from one medical man to another, and who crowd our watering-places in summer; most of them are suffering from chronic uterine inflammatory disease unrecognised and untreated, and most of them would, if their disease were only discovered and cured, become amenable to the resources of our art, and eventually recover their health, spirits, and powers of locomotion. It is a singular and instructive fact that amongst the male part of the community there is no similar invalid population, always ill, unable to walk or ride, constantly requiring medical advice, and yet living on from year to year, neither their friends nor themselves knowing what is amiss with them, beyond the evident weakness, dyspepsia, etc."

The symptoms, also, which Gooch ascribes to the irritable uterus we now attribute to chronic metritis. "To embody them in one view, let the reader fancy to himself a young or middle-aged woman, somewhat reduced in flesh and health, almost living on her sofa for months, or even years, from a constant pain in the uterus, which renders her unable to sit up or take exercise; the uterus, on examination, is unchanged in structure, but exquisitely tender; even in the recumbent posture, always in pain, but subject to great aggravations more or less frequent." He thus describes exacerbations which are characteristic: "No disease, however, is so liable to relapse. The patient, feeling easy, finding herself feeble, and supposing that air and exercise are necessary to the recovery of her health, rises and goes about again, and after a short interval of caution, throws aside her fears, engages in walks, rides, and gaiety, or takes a journey to the sea for the recovery of her health. This conduct commonly occasions a complete relapse, and the patient and her attendant are again involved in the former suffering, apprehensions, and difficulties."

It may be said that some of the cases described by Gooch were cases of affections of the Fallopian tubes, which were not recognised at the time at which he wrote. The line of treatment, however, adopted and the improvement under it, show that we are justified in considering them as cases of chronic metritis. Gooch's reason for not calling the condition a chronic inflammation—namely, that the latter is a disorganising process, while the irritable uterus shows no alteration in structure—proves, on the contrary, that his cases were just what we would now describe as chronic metritis, the results of which tend to be permanent.

The most frequent symptom is pain in the lower part of the abdomen and in the loins. Sometimes it is spoken of as fulness or weight in the pelvis, or bearing down. In one word, as Pozzi puts it, the patient knows that she has a uterus. The pain is worst when she is going about, and relieved when she lies down. In this respect it differs from the pain of cancer, which is independent of exertion, and is often described as worse when she is resting at night—probably because there is less to distract her attention from it. Whatever increases abdominal pressure and tends to move the sensitive uterus produces pain. Well-to-do patients, who can take relief by lying on the sofa, gradually come to spend most of their time there.

The aggravation of the pain by movement, and its relief by rest, raise the question whether the cause of it be not sensitiveness in the attachments of the uterus, rather than in the organ itself; whether it be not, in fact, an associated parametritis or perimetritis? In many cases, however, we cannot find evidence of these affections. If I were to draw a fine distinction I should say that when pain is aggravated by movement of the uterus—as may be demonstrated on bimanual examination or the use of the sound—rather than by simple pressure in the iliac regions, the lesion is chronic metritis, not perimetritis. We cannot always be sure that painful cicatrisation in the broad or utero-sacral ligaments is absent. The pain is often more marked in the left iliac region, which may indicate cicatrisation in the left broad ligament; as most cases of chronic metritis date from the puerperal condition, in which left-sided cellulitis is more frequent because of the greater frequency of left-sided lacerations of the cervix. Pozzi ascribes this pain to inflammation of the left Fallopian tube, though he can give no reason why the left tube should be affected rather than the right. The pain, moreover, is increased by the congestion of the menstrual period, an increase which is ascribed to the flushing of the painful uterus with blood. Sometimes, however, patients are relieved by the menstrual flow as by a local depletion.

Neuralgic pains are frequent, though it is difficult to say whether these are due to a source of irritation in the uterus, or to the general "run-down" condition of the system. The disturbances of digestion may more justly be regarded as reflex neuroses—such as the gastric disturbances of pregnancy, which depend upon the close relation between the uterus and the digestive system. The constipation, which is a constant complaint, results probably from the want of exercise; but sometimes it is due to shrinking from the pain of defæcation. In the acute exacerbations, indeed, there may be diarrhœa with tenesmus, due to extension of inflammation to the rectum; as there may be frequent and painful micturition from the extension of inflammation to the bladder.

Disturbances of menstruation are often given as symptoms of chronic metritis. Painful menstruation is certainly one of them, and is accounted for by the congestion of a tender uterus. Profuse menstruation should, however, be referred to an accompanying endometritis; though Fritsch thinks the connective tissue formation in the wall affects the contractile power of the uterus, which he considers one of the factors which regulate the amount of the menstrual loss. In some rare cases profuse bleeding has been associated with sclerosis of the vessels of the uterine wall, a condition only diagnosed on hysterectomy. The possibility of the hæmorrhage being due to an associated salpingitis, which has its own appropriate treatment, should also be borne in mind.

The disturbances of the reproductive function (sterility and abortion) are also to be accounted for by the accompanying endometritis.

The general effect on the patient's nervous system is perhaps the most important of all the consequences of this malady, and shows itself in asthenia and hysteria. It is extremely difficult to say how far these elements enter into individual cases, but an accurate appreciation of the proportion between the general and the local factors in these very complex cases is of the first importance when treatment has to be considered. By asthenia we mean the real loss of energy which can only be made up by such a line of treatment as the Weir Mitchell. [See the article on "The Nervous System in Relation to Gynæcology."] Hysteria, of which the treatment is rather a mental and moral régime, is also an important element in the malady. It is only by taking into account the condition of the central nervous system that we can explain the great variability in the amount and seat of the pain in chronic metritis, the sudden improvements and relapses, and those cures in which the result bears no proportion to the means employed.

Pathology in relation to Physical Signs.—Still less is known of the pathological changes in chronic metritis than in endometritis or cervical catarrh. We have seen that the accessibility of the cervix to microscopic examination in the living subject has, during the last twenty years, given precision to our knowledge of its pathology, and that the curette is performing a like service for the endometrium in enabling us to study its pathological changes during life. An opportunity, however, for examining the condition of the wall is only given in the rare cases of extirpation of the uterus.

Scanzoni's classical monograph on chronic metritis deals entirely with the naked-eye characters.

The microscopic changes have been described by De Sinéty, Fritsch, and Cornil, but further observations are needed.

Scanzoni describes two stages—an early stage in which the uterus is enlarged, hyperæmic, and soft, and a later one in which it is indurated, anæmic, and hard. Clinically it is impossible to distinguish two such stages: sometimes we find a soft uterus, and sometimes a firm one; but no clinical observations have demonstrated that the one condition follows the other in the same patient. Scanzoni's description is the result more of logical deduction from what we know of pathological changes in other organs than of direct study of the uterus.

De Sinéty follows Scanzoni in describing two stages. The first is characterised by "the presence in great number of embryonic elements throughout the whole thickness of the muscular wall. These elements are met with specially round the blood-vessels, or form islands of variable dimensions which are more or less apart." In the second stage he describes marked dilatation of the lymphatic spaces, and a localised hyperplasia of the connective tissue round the blood-vessels. Fig. 83 is a section of the uterine tissue from one case which he examined.

Fritsch's observations were made on uteri which, extirpated for cancer, also showed the naked-eye appearances of chronic metritis. He found that the disposition of muscular fibre and connective tissue is less regular than in the normal uterus, the individual muscular bundles being split up into small irregular ones. The connective tissue is greatly increased in amount, and its bundles show remarkable bulging and undulations in their course. Areas of normal tissue may be found in the same uterus, showing that chronic metritis may occur in patches. The blood-vessels are more numerous and tortuous, and thus in places produce the appearance of a cavernous tissue; their walls are thickened, especially in the middle coat; the contour of the vessel is masked by a connective tissue replacing the muscular elements in the wall, and the lumen of the vessel is often diminished. The lymphatics appear as gaping spaces instead of narrow clefts. The peritoneum is also thickened.

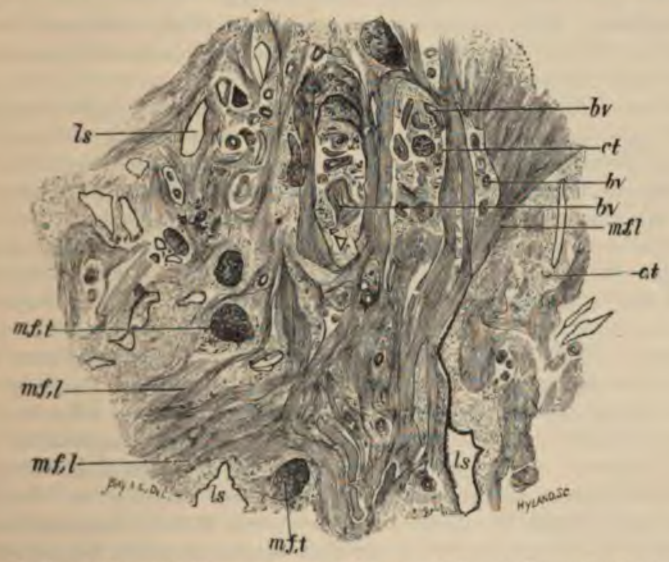


FIG. 83.—Section of the uterine tissue in a case of chronic metritis. *ct*, Connective tissue round the blood-vessels, *bv*; *ls*, dilated lymphatic spaces; *mf, l*, muscular fibre cut longitudinally; *mf, t*, muscular fibre cut transversely (De Sinéty).

Fritsch holds that the multiparous uterus must always be richer in connective tissue than the nulliparous; seeing that where the special tissues are destroyed by inflammation connective tissue takes their place, and that few multiparæ have not had inflammation in the puerperium.

Cornil also describes, in cases of chronic metritis independent of parturition, a new formation of connective tissue between the muscular fibres; in the tissue opaque points are seen, which represent arteries undergoing atheromatous degeneration. Their walls are thickened by elastic tissue. There is no cicatricial contraction of this connective tissue, but a permanent increase in volume.

It is not necessary here to recapitulate the views advanced under the head of pathology in the works of other writers on chronic metritis; these opinions resolve themselves into a discussion of the meaning of chronic inflammation instead of giving pathological data for determining the features of the changes in the uterus. The observations of De Sinéty, Fritsch, and Cornil go to show that the essential change in chronic metritis is increase of connective tissue in the uterus, being therefore somewhat analogous to that which occurs in fibroid tumour, save that the connective tissue formation is diffused through the uterus instead of being localised in masses. Thus pathology is the key to the physical signs. The uterus is enlarged throughout: there is no alteration in its form; its consistence may be either firm or yielding. This equable enlargement of the uterus can be made out by careful bimanual examination, and confirmed if necessary by the use of the sound.

Diagnosis.—The conditions which are most likely to be mistaken for chronic metritis are enlargement of the uterus from commencing pregnancy, small fibroid tumours, and malignant disease.

In the case of early pregnancy, amenorrhœa and other symptoms should put us on our guard. The cervix is softened, although this softening is not so well marked in a multipara where the cervix has been previously indurated by chronic inflammation; the bimanual examination shows the change in the form of the uterus due to growth of the ovum. In chronic metritis there is no alteration in the shape of the uterus, but in pregnancy there is a globular enlargement; the vaginal finger recognises the anterior wall bulging out from the cervix, while the abdominal hand feels the rounding out of the fundus, combined with a softness which prevents us from distinctly defining its outline. Where resistance of the abdominal walls makes the bimanual examination difficult, the finger may be able to recognise through the rectum the bulging and softness of the posterior uterine wall in contrast with the thin and compressible lower uterine segment. Pregnancy can be detected by careful bimanual examination as early as the eighth week. Where there is any doubt, by waiting a few weeks the diagnosis from chronic metritis becomes easy.

Small fibroid tumours closely simulate chronic metritis. The symptoms are the same; and on bimanual examination it is often extremely difficult to distinguish the uneven enlargement of a fibroid from the uniform enlargement of chronic metritis. By passing the sound so as to define the course of the uterine canal and the position of the fundus, and then making a careful bimanual examination with the sound in position, we are able to detect small fibroids of the anterior or posterior wall. Intra-uterine fibrous polypi can only be recognised by dilating the cervix.

While the diagnosis of chronic metritis from small fibroids is often of little moment, the diagnosis from early malignant disease is of great consequence. The age of the patient, the character of the pain, and the nature of the discharge, must all be taken into account. Free bleeding is also more suggestive of malignant disease, especially after the menopause, although I have seen patients with fungous endometritis and chronic metritis lose a considerable amount of blood. In doubtful cases the cervix should be dilated so as to allow the endometrium to be carefully examined with the finger or curette.

Treatment rests upon pathology; and the view we take of the nature and etiology of chronic metritis determines our treatment. The pathological facts, so far as we know them, indicate that the lesion consists in an increased formation of connective tissue in the uterus, and that the most favourable circumstances for its development occur during the puerperium. Sir James Simpson rendered a great service by calling it "subinvolution," thus drawing attention to the importance of the puerperal state in connection with its etiology. The best treatment is preventive; and the removal of whatsoever interferes with the involution of the uterus is to be put in the forefront in the treatment of chronic metritis. Attention to the complete emptying of the uterus after delivery, and early removal by curetting of portions retained after abortion, are of the first importance. To stimulate the involution of the uterus by douching during the puerperium, to administer ergot, to order sufficient rest, and to forbid patients to return too soon to their ordinary duties, are measures of preventive treatment which cannot be overrated in importance. Fortunately patients with chronic metritis are not often sterile; and it is to the proper management of a subsequent puerperium that we must look for the treatment of this condition. The natural cure that then takes place is the only efficient one.

On passing now from preventive treatment to the general treatment of metritis, we shall find that to describe the treatment recommended by the various writers on this subject would be simply to recapitulate all the resources of gynæcological therapeutics. Thus is revealed the importance of the lesion, inasmuch as all the means at our command have been employed with more or less success in dealing with it; yet variety of treatment generally means ignorance of the nature of the disease; as our knowledge grows our treatment is simplified.

The main object of local treatment is to diminish passive congestion of the pelvic organs; and here again the first indication is rest. Continuous rest, however, is bad, for it favours congestion; daily exercise in the open air is as necessary as an hour or two of rest on the sofa in the middle of the day. Tight garments which compress the abdomen should be discarded; on the other hand, where the abdominal muscles are flabby, a well-adjusted abdominal belt often makes the patient more comfortable. Lax abdominal muscles are occasionally associated with a relaxed vagina and a tendency to prolapse; in such cases a ring pessary to support the heavy uterus is useful.

To stimulate the pelvic circulation the hot douche is invaluable. It should be administered freely in the recumbent posture, and, if possible, by a trained nurse. It is of little value unless it is done thoroughly.

Preparations of ergot also lessen uterine congestion. It is in the puerperium that we expect the most permanent benefit from this drug, on account of its action on the muscular fibres of the uterus, promoting their contractions and favouring their involution. Ergot is also useful in other circumstances, especially where there is menorrhagia. The liquor hydrastis canadensis may be used alternately with ergot, although it is not nearly so trustworthy.

The passive congestion can also be relieved by depletion, although this is not used nearly so much now as formerly. The best mode is by scarification of the cervix; but we would limit its use to cases where there is marked cervical hypertrophy. A more practical method is the abstraction of serum from the tissues by glycerine tampons, which have this advantage that they can be applied by a nurse, or even by the patient herself. A 10 per cent solution of ichthyol in glycerine I have found even more serviceable than simple glycerine. A course of systematic douching, combined with ichthyol tampons, in the hands of a trained nurse for several weeks is, in my experience, the most satisfactory local treatment for chronic metritis. Where the parts are too tender for the regular application of ichthyol tampons, ichthyol pessaries are a useful substitute.

Attention to regular evacuation of the bowels is of the greatest consequence, not only for lessening pelvic congestion but also for improving assimilation. The benefit derived from certain mineral waters is probably due largely to their aperient action as well as to the regular mode of life prescribed at the different health resorts.

When exacerbations occur, showing that the affection has become acute for the time, we have recourse to hip-baths or warm fomentations, with complete rest; and to morphia suppositories to relieve the pain and check the diarrhœa which are sometimes present. For the irritability of the bladder the hot vaginal douche and the usual sedatives are useful.

Where cervical catarrh or endometritis are the prominent features, these must be treated in the first instance; and the treatment directed to them will lessen the chronic metritis. While separating these various affections for the purpose of studying them, we must remember the intimate relation that exists between them; so intimate is it, that some writers prefer to consider inflammation of the uterus as one affection varying in its manifestations according to the tissue affected. I do not accept this view, inasmuch as it suggests that there is an entity—inflammation—appearing in one tissue after another. Of the close causal connection, however, between inflammation in one part and another, there is no doubt. Chronic metritis is intimately related both to endometritis and to cervical catarrh, and can sometimes be treated only through these. Thus, after curetting the uterus for endometritis following abortion, or after amputating a hypertrophied cervix, we find an enlarged uterus becoming smaller, and the general condition of the patient undergoing improvement.

Attention to the general health is of great importance. The patient's diet requires careful study, and we must have regard to digestion as well as to appetite. While some patients require feeding up, others call for a restriction of food. A patient may eat well and largely, and yet assimilation may be defective. When this is the case, alcohol is often taken, from the idea that it aids digestion instead of retarding it. Marked improvement in the patient's general condition often follows on the prescription of a dietary of light and easily digested food, with a diminution in the amount of stimulant. Each case must, of course, be studied by itself. No rules can be laid down except that we should not let the condition of the uterus divert attention from the condition of the stomach.

Change of air, change of scene and occupation, are invaluable. It is to their influence as much as to the mineral waters that the benefit from visiting the various spas is due. It would be out of place here to enumerate them, and the subject has become of such importance that special works on the subject must be consulted.

The operative treatment of chronic metritis occupies a very subordinate place. After operations on the cervix it has been noted that an enlarged uterus diminishes in size; this is specially the case after amputation of the cervix. Although this is a very important result of the operation, the value of which I have noted repeatedly, I should hardly describe it as a means of treating chronic metritis, as the operation is only called for where the hypertrophy of the cervix itself is so great as to justify amputation on independent grounds. Of the diminution of the uterus after Emmet's operation I have not been able to satisfy myself, although Emmet and other American operators claim this as one of its beneficial results. Of the igni-puncture of the cervix advocated by Prochownik, I have had no experience.

Tuberculous Inflammation of the Uterus.—While tuberculosis of the uterus is occasionally met with at necropsies of cases of phthisis, it rarely presents itself to the clinician. It is not so frequent as tuberculosis of the tube, from which it may be derived by an extension of the process. Very rarely is it a primary affection of uterus or cervix, the condition being as a rule secondary to its presence in the lung, or occurring as part of a general infection.

As to its frequency we have no exact data. Tuberculosis of the genital tract is said to occur in from 2 to 8 per cent of post-mortems in cases of phthisis, while the results of different operators show its occurrence in from 2 to 4 per cent of cases of abdominal section. Späth found the uterus to be involved in 76 per cent, or about three-fourths of all the cases of genital tuberculosis.

As regards its etiology, predisposition of the tissue to infection, and the introduction of the tubercle bacillus, must be the factors as in all cases of tuberculous inflammation. As to the first of these it is noteworthy that in some cases the body of the uterus alone, in other cases the cervix, is affected; but why this should be so is not known. It is more common early in life, occurring most frequently between the ages of twenty and thirty. Several cases have, however, been mistaken for cancer about the menopause, and Horrocks has recorded a case in a patient of seventy. Of the various modes in which the tubercle bacillus may reach the uterus, the most frequent is infection through the blood, or from the peritoneal cavity. It is rare to be able to trace infection as occurring from without, though unclean touch, contamination from tuberculous stools, or instruments, or syringes may carry it. The question of infection through coitus has given rise to a good deal of discussion, but very few clear cases have been placed on record. Glöckner has recorded a well-authenticated case, and Derville mentions six cases, but does not give sufficient proof that the inflammation of the epididymis, to which infection was ascribed, was tuberculous. It occurs either as miliary tuberculosis, or as an interstitial condition, or as superficial ulceration, and may show itself in the body or cervix, or both.

Tuberculosis of the cervix, although the rarer form, has a special clinical importance from its simulating cancer of the cervix. Its rarity is evident, for Beyea could collect only seventy cases in all the literature up to 1900; of these fifteen had been observed clinically, and the necropsies showed that they were associated with tuberculosis of other organs. In two alone was it demonstrated to be a primary affection of the cervix; but other cases have since been reported by Lewers, Croft, and Brook. In two interesting cases recorded by J. D. Williams, while the affection was secondary to tuberculosis of the lungs, the cervix was the only part of the genital tract affected. The diagnosis of tuberculosis of the cervix may be difficult. The ulcerative condition and the purulent discharge, sometimes tinged with blood, suggest a malignant condition, from which diagnosis can only be made by the microscope.

In tuberculous endometritis the uterine cavity may be filled with caseous material. In many cases the process stops definitely at the os internum, and diagnosis is only possible after dilatation of the cervix or the examination of tissue removed by the curette. Here the presence of giant cells or tubercle bacilli is pathognomonic. The section given at Fig. 84 is of the scrapings from the uterus of a patient under the care of Dr. Brewis, who has kindly given me the following particulars:—The patient was a nullipara, aged fifty-two, and a year past the menopause, in whom loss of flesh and a discharge from the uterus suggested malignant disease. The os uteri was patulous, and the body irregularly enlarged and retroflexed. The microscopic section shows that the condition was not malignant, but tuberculous; and the patient has, since the operation two years ago, been well.

Treatment will depend on the seat and extent of the lesion, and whether it stands alone or is a part of a general condition. Where the disease is cervical it may be treated in the first instance with tincture of iodine or iodoform; but excision of the affected tissue is to be preferred. The cervix may be amputated, or the curette or thermo-cautery used to destroy as much of the diseased surface as possible. Where the condition is in the endometrium curetting is performed in the first instance, and is necessary for diagnosis. Whether it should be followed by hysterectomy will depend on the subsequent progress of the case. While this would seem the most satisfactory treatment, where we can exclude the presence of tuberculosis in other organs, the difficulty of doing this raises the question whether the major operation is justifiable. If it is to be performed it should be done by the abdominal route, as the Fallopian tubes are frequently diseased.

Senile Endometritis.—At the menopause the uterus ceases its function, and its mucosa undergoes retrogressive changes. Endometritis, which is specially related to the physiological activity of the endometrium, loses its importance, except as an accompaniment of the presence of new formations, such as mucous polypi, fibroids, or cancer. A pathological condition of the endometrium may, however, arise, apart from tumour growth, to which the term senile endometritis has been applied. It calls for separate consideration, as it is related to the atrophic processes which occur after the menopause; just as other forms of endometritis are related to the hypertrophic processes associated with the period of sexual activity.

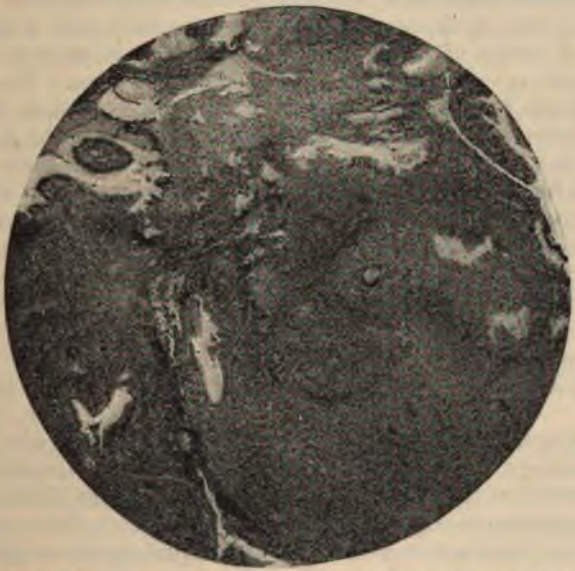


FIG. 64.—Section of tissue removed by the curette from a case of tuberculous endometritis (40 diameters). Note the giant cell system near the centre of the field.

At the climacteric the retrogressive changes are these: the cylindrical epithelium is shed, small polymorphous cells take their place, and the uterine cavity comes to be lined with a layer of connective tissue. Should septic infection occur while this process is going on, senile endometritis results, giving rise to a muco-purulent discharge, which may be very fœtid. Sometimes it accumulates in the uterine cavity and comes away in gushes. With this fœtid purulent discharge there may be some bleeding, which has been ascribed to sclerosis of the arteries. The septic infection may produce general symptoms, *e.g.* cachexia with sallow skin and some emaciation.

Such cases are comparatively rare, but are important because the clinical picture often strongly suggests malignant disease. The course is, however, more chronic; pain and hæmorrhage are not pronounced, the uterus is not enlarged, and the local changes, due to the extension of malignant disease, are wanting. The treatment is to wash out the uterus with an antiseptic. Sometimes it is necessary to dilate the cervical canal. After washing it out, the cavity should be packed with gauze so as to ensure drainage. In other cases curetting, followed by the application of pure carbolic acid, iodised phenol, or formalin is called for.

Pyometra.—This is the name given to the condition of distension of the uterus with pus, with or without occlusion of the cervical canal. As a primary lesion it is rare, but is most commonly met with as a complication of cancer of the cervix; Bürkle found it present in 17 out of 273 cases of cervical cancer, *i.e.* about 6 per cent. The ulcerative process allows of the access of germs to the endometrium, so that should the canal become blocked by extension of the growth, the accumulated secretions become converted into pus. In some of the recorded cases the uterus has been much distended, and yet the cervical canal was patent; the explanation of such cases is probably the blocking of the canal by clots, together with the loss of ciliary action and diminished contractile and expulsive power of the uterus; as the patients were, in nearly every instance, long past the menopause. In many cases there is, besides the cancerous process, a definite senile endometritis, and in such the secretion is more abundant and the distension of the uterus greater. A case has been recorded by Griffith where the obstruction was due to a fibroid tumour.

It may result from a simple senile endometritis, the discharge from which is always of a purulent, fœtid nature. The condition which usually determines the retention of the discharge and the distension of the uterus is an accompanying senile cervical catarrh, which produces occlusion of the cervix; but other conditions, such as cervical cancer or other growth, may be the cause. Several cases have been recorded where the cervical canal was patent and even patulous, so that, as in cancer, cervical atresia is not a necessary factor; the patients were all a long time past the menopause. Galabin has pointed out that some of these cases are secondary to cancer of the body of the uterus, although naked-eye examination may fail to detect the malignant growth.

More rarely is it due to congenital atresia of the cervix, which, at the onset of menstruation, gives rise to hæmatometra. If by any means organisms gain access, pyometra results. The organisms may reach the uterine cavity by a small opening forming externally, or in some cases the occlusion may not be complete. Christopher Martin records a case in a uterus bicornis, and one in one-half of a septate uterus. In the same paper he gives two cases of hæmatometra with double pyosalpinx, the infection of the tubes having apparently taken place through bowel adhesions. Probably had these cases been allowed to go on pyometra would have resulted.

Pyometra may occur, however, without antecedent hæmatometra, as in the interesting case recorded by Rheinstaedter of pyometra with pyocolpos in a child of thirteen years. The distended uterus reached to the umbilicus, and on incising the obstructing membrane pus was evacuated which had apparently collected before the onset of menstruation.

Pathology.—The uterus becomes converted into a more or less globular sac. The quantity of pus contained varies, but may amount to several ounces. It is always of a very fœtid nature, owing to the frequent presence of bacillus coli communis and putrefactive organisms; in four out of five cases examined by Lea, however, it was sterile. The uterine wall is in a state of acute inflammation and infiltrated with leucocytes. As a rule there is loss of surface epithelium and atrophy of glands, but Lea has noted considerable glandular increase in some cases.

Symptoms.—These vary with the cause, and according as the cervix is or is not occluded. In congenital atresia there will be the history of symptoms of hæmatometra followed by rigors, sweating, and rise of temperature, together with increased and more continuous pelvic pain. In cancerous cases the symptoms are usually masked by those of the primary affection, and the condition may only be discovered at the time of operation; when the cervix is pervious the intermittent escape of large quantities of fœtid pus will be noted. This is also the prominent symptom in cases secondary to senile endometritis without cervical occlusion. The discharge of pus is usually preceded for a few days by severe pelvic and abdominal pain, sickness, rigors, and elevation of pulse and temperature; with the escape of the pus these symptoms subside to be repeated when the uterus again fills up.

Physical Signs.—The uterus is found to be enlarged and globular, and is of an elastic, semi-fluctuating consistence, and if the cervix be patent the pus may be squeezed out.

Treatment.—This varies in different cases. In those secondary to hæmatometra the treatment is the same as for that affection; should, however, pyosalpinx or hæmatosalpinx be associated with it, abdominal section should be performed, and the affected tubes removed; the uterus may then be drained from below and washed out, or excised, should this appear to be necessary. In cases due to cancer the entire uterus should be removed, either by vaginal or abdominal hysterectomy, care being taken to prevent soiling of the peritoneum with pus. When the case is too advanced for hysterectomy, the carcinomatous obstruction may be removed by the curette, and the uterine cavity washed out and packed with gauze.

All that is necessary in cases secondary to senile endometritis is opening up of the cervical canal, evacuation of the pus, and irrigation of the uterine cavity with an antiseptic, followed by the introduction of an iodoform gauze drain. If there be any suspicion of cancer of the body of the uterus, hysterectomy ought to be performed.

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BENIGN GROWTHS OF THE UTERUS

The uterus is undoubtedly the most common seat of new growths in the human body. Exact statistics as to their relative frequency cannot be quoted; indeed, statistical evidence of the relative frequency of neoplasms generally must be untrustworthy. From the researches of v. Gurlt, however, compiled from the Vienna Hospital Reports, which embrace 15,880 cases of tumour, it appears that females exceeded males in the proportion of seven to three; and of this large majority in the former, uterine growths accounted for 25 per cent, while the other sexual organs, including the mamma, contributed about 20 per cent.

The cause of this great frequency of new growths in the uterus is unknown; but when we consider the variety of its tissues, its constantly recurring periodic engorgements, and the alternate hypertrophy and involution it undergoes in connection with pregnancy, we may anticipate its special proneness to disease, and in particular to neoplasms. That these conditions enter into the causation of the new growths is proved by the extreme rarity of congenital growths, and by the infrequent development of neoplasms before puberty; while after the menopause simple tumours rarely occur, and the malignant kinds in the great majority of instances are found in women who have previously borne children; their development may be favoured by the bruising and laceration consequent upon parturition.

Simple tumours, especially fibroids, were supposed to be more common in the coloured races; but this assertion has lately been contradicted.

Easy social circumstances seem to be associated specially with the development and growth of uterine fibromyoma, in contradistinction to the preponderance of uterine cancer in the poor and badly nourished.

The classification of uterine growths of a simple character may be most practically and simply considered by dividing them into two primary groups : (A) tumours of the muscular wall, and (B) tumours of the mucous lining.

A. Tumours of the Muscular Wall

These are practically represented by one variety, the fibromyoma; these tumours, however, may undergo a large number of secondary changes that so transform their original structure, that one is tempted to describe them severally as independent types of neoplasm. It is, however, more simple and practical to attribute them entirely to secondary changes in pre-existing fibroids.

The Fibromyomas—also known as fibroid or fibrous tumours, myomas, leiomas, and hysteromas—are by far the most common of uterine new growths. They are stated by Bayle to occur in 20 per cent of all women over thirty-five years of age ; while in women of fifty, Klob (37) estimates their frequency at 40 per cent. Fortunately these statistics were compiled from an exhaustive and detailed examination of uteri after death, in the majority of which the growths were so small as to give rise to no inconvenience or any indication of their presence during life. It is, therefore, of much more practical interest to make an approximate estimate of the percentage of women who suffer from pelvic symptoms due to these growths. For this purpose I have consulted the case-books of the Edinburgh Royal Infirmary, which show that of 2230 gynæcological cases, in only 176 (8 per cent) was fibromyoma the cause assigned. The figures thus obtained must necessarily be considerably within the actual proportion, as only patients suffering from urgent symptoms are treated as in-patients; while a large number of cases of fibroids are attended with minor symptoms. Further, as is well known, these tumours are more commonly met with in the more affluent classes which do not attend at hospitals. Yet when we compare the rarity of fibromyoma in gynæcological practice with the statistics of Klob and Bayle, based upon their presence in women generally, it must be assumed that the proportion of fibroids, which give rise to any symptoms whatever, is exceedingly small.

Fibromyomatous tumours are associated with the period of sexual activity. Their growth is practically confined to the years between puberty and the menopause, and it is doubtful if they ever originate before or after this period ; indeed, if uncomplicated by secondary changes, they cease to grow after the climacteric. In Winckel's tables two cases are quoted as occurring in women over seventy years of age ; and many cases are recorded in women over sixty. It is probable, however, that these were due to secondary changes occurring in pre-existing and unnoticed tumours, changes which are by no means an infrequent result of chronic œdema.[1] A curious and interesting case is cited by Bland-Sutton, in which a tumour, supposed to be a fibroid, was present for ten years in the uterus of a childless widow, twice married, who had never menstruated, or shown any physiological evidence of ovulation.

The earliest example cited is in a girl ten years of age (26), but unfortunately no account is given of the microscopic structure of the growth or of menstruation.

Opinion is divided as regards the influence of the sexual functions upon the development and growth of fibromyoma; but, strangely enough, this difference of opinion lies almost entirely between the pathologists on the one hand and the gynæcologists on the other. The former maintain that these growths largely predominate in the unmarried, and Cohnheim (11) even asserts that sterility leads to their formation. No statistics have been produced in support of this assertion. The majority of gynæcologists entertain the opposite opinion; and most trustworthy investigators—such as Schröder, Winckel, Gusserow, and others—have adduced overwhelming evidence on this side of the argument. Thus Schröder found 614 married women in 792 cases; and Winckel and Gusserow consider the proportion of the married to the single to be as two to one. In the records of the Edinburgh Royal Infirmary of the last 100 cases 37 were single and 63 married, and nine of the single women had borne children. In private practice 39 of the last 100 cases upon whom I have performed hysterectomy for fibromyoma were single. It seems difficult at first to reconcile such conflicting statements; but on consideration of the very different sources of information—namely, post-mortem examinations and clinical experience—the inference appears that the great majority of tumours originate independently of sexual irritation, at least so far as intercourse is concerned; but that their subsequent growth is so favoured that symptoms and signs of the presence of the tumour more frequently arise.

The influence of fibroids upon child-bearing has at all times been a fruitful source of discussion, sterility being regarded by some observers as a cause of their development (Emmet). Others look upon sterility as a consequence. In support of the latter opinion almost incontrovertible evidence has been brought forward by West, Scanzoni, McClintock, Winckel, Schröder, and many others, whose combined statistics show 621 cases of absolute sterility in 2035 cases of fibroids; that is to say, about 30 per cent were childless. When this is compared with the average rate of sterility, *i.e.* 10 per cent (17), one is compelled to admit that they exercise a preventive influence on conception. That the sterility is due to the tumour, and not the tumour to the sterility, is strikingly supported by the important statistics of relative sterility as quoted by Winckel and Susserot (61). These afford convincing proof of the undoubted preventive effect of fibromyomata upon child-bearing. Their combined cases show that 99 fruitful women with fibroids bore only 276 children, an average of 2·8; the normal average of children to each mother in the same locality being 4·5. Again, in this connection the Edinburgh statistics are of much interest. The 63 married women previously referred to had 130 children; 32 were absolutely sterile, giving an average of 4 children to each of those who had been pregnant. But the average date of their last pregnancy (no widows were considered) was over 11 years before their treatment in hospital, a most striking proof of the sterilising effect of the presence of the new growths. Still more striking are the figures derived from my private practice. Of the 61 married 37 were absolutely sterile; the remaining 24 had 69 children. There was, however, only an average of 8½ years' sterility before seeking advice. This is because the better classes seek advice sooner than the poorer. West found that of 36 fruitful women with fibroids, the average number of children to each mother was scarcely two; 20 of the 36 mothers had but one child each, a most striking contrast to the statistics of Ansell, which show that normally only one in 13 mothers have but one child.

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[1] See *Fibrocystic Growths*, p. 295.

The statistics of the effect of sexual excitement and child-bearing on the development and growth of fibroids seem to lead to the following conclusions:—

(1) That fibromyoma originates in the majority of instances independently of marriage and pregnancy.

(2) That sexual excitement in marriage favours its growth.

(3) That it tends to prevent child-bearing.

(4) That pregnancy seems to promote its growth to a great extent, so that future conception is in many cases prevented, and signs and symptoms of its presence are manifested. In reviewing in detail the subject of the effect of fibroids on pregnancy, it will be shown that sterility is further promoted by the preventive effect of these tumours on the growth of the ovum.

Pathological Anatomy.—Fibromyoma may be found either in the body or in the cervix uteri; in the former site, however, it greatly predominates; only 4 per cent occur in the cervix. It is said to occur more frequently in the posterior than in the anterior wall, although from experience I cannot corroborate this statement.

The origin of these tumours has been and is still a source of much speculation. Some attribute them to the organisation of blood accidentally extravasated. Others state that they have found bacterial colonisation as the nucleus of the growth, a statement effectually disproved by Marey. Klebs attributes them to a proliferation of the connective and muscular tissues of blood-vessels, a theory which is supported by the general disposition of the muscular bundles parallel to the vessels in the tumour. The actual histogenesis has yet to be proved.

In size these growths vary from less than a pea upwards, and have been recorded of the enormous weight of 140 lbs. (32).

They are most frequently multiple, and in but very few instances of apparently solitary tumours will a minute examination fail to detect other small nodules in the uterine wall. In some cases as many as fifty independent tumours may be found in the same uterus. A well-marked exception to the general rule of multiplicity is to be found in the case of the so-called œdematous fibroid, which in the large majority of instances is solitary.

Formed from the same elements as the uterine wall, the gross characters of fibromyoma vary considerably according to the relative excess of muscular or fibrous tissue in their structure; usually these growths are of a firmer consistence than the uterine wall from which they spring. In some cases, when composed largely of muscular tissue, they are soft, and give the impression of a simple hyperplasia of the uterine tissues. On section the soft varieties have a reddish-pink appearance, and to the naked eye are more uniform in structure than the commoner hard variety. These on section appear pinky-white, with wavy, glistening, whitish bands coursing in every direction, but with a decided tendency to form whorls round individual centres, an appearance which gives rise to the not inapt comparison to "a ball of wool." This characteristic appearance is due to the mode of growth of the tumour, the muscular tissue closely following and the blood-vessels running parallel to them. Thus they closely simulate development from a number of distinct centres; but their origin from a single focus is proved by other observations, such as the extreme rarity of more than one nodule within the same capsule, and the smooth, spherical form of all nodules free from irregular pressure. The cut surface of fresh sections is uneven, the elasticity of the fibrous tissue causing the softer muscular bundles to bulge externally.

The growth is usually enveloped in a false capsule, derived from the uterine tissues which have undergone marked compression changes from the constant and ever-increasing circumferential pressure of the developing tumour.

As the capsule is formed by the surrounding tissues, it varies in thickness according to the original site of development of the tumour. Thus when the growth originates in the middle layer of the uterine wall the surrounding capsule will be thick and well formed; but if the tumour develop in the external or internal layers of the uterine muscle, the intervening muscular layers between it and the superimposed peritoneum, or mucosa, must necessarily be but scanty, and the capsule correspondingly thin; indeed, in some cases the muscular capsule is entirely absent, the tumour being covered by the peritoneum or the mucosa alone.

Between the tumour and the so-called capsule there is a layer of loose connective tissue in which the growth is embedded, so that in some cases the mass may be readily enucleated. In other instances, however, many strong muscular and fibrous bands pass between the growth proper and the capsular wall, which prevent so ready an enucleation; in some of the softer tumours these intervening bands are so numerous as to obscure any line of demarcation between the tumour and surrounding muscle, and thus the whole mass appears to be a simple hyperplasia of the uterine wall.

In the capsule, and embedded in the loose connective tissue between it and the tumour, may be seen the numerous and large blood-vessels surrounding the tumour from which it derives its nourishment. These do not penetrate the substance of the growth to any great depth, and thus sections of well-formed vessels are but seldom found away from the periphery. Their vascularity is but slight in comparison to that of the uterine wall from which they spring, as is well shown in Fig. 85, taken from a preparation of an injected uterus with fibroid. In the harder varieties blood-vessels are extremely scanty, especially towards the centre of the growth; but in the softer growths they are much more numerous. They are rarely well formed, however, and appear rather to be of the nature of sinuses. Thus it is that the blood-supply is usually scanty, and the circulation at the best slow and difficult.

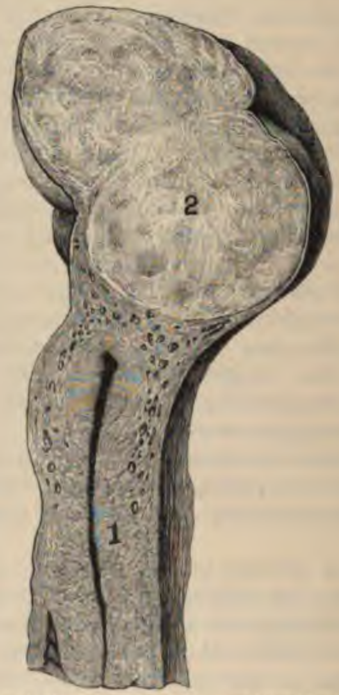

FIG. 85.—Injected uterus with fibroid, showing numerous large blood sinuses in uterine wall. From specimen, Anatomical Museum, Edinburgh.

Normally of a smooth, round, uniform shape, the spherical contour of the original nodule may become much modified by the effects of irregular pressure, or by the development of secondary nodules in its capsule.

When examined microscopically these tumours are found to be composed entirely of muscular and connective tissue elements, which vary widely in relative quantity. When young and in rapid growth, the muscular tissue, as a rule, largely preponderates; but it would appear that in the majority of cases the connective fibrous tissue slowly increases at the expense of the muscular, which occasionally it almost entirely supplants. It is thus evident that no constant appearance can be assigned to the growth, as its structure varies within broad limits. It is usual in young and rapidly growing tumours to find the muscular elements preponderating; but although I have examined a large number of tumours, I have never yet seen an example in which (as some authors maintain) the fibrous tissue is so scanty in proportion that it may be neglected, and the tumour reckoned as a pure myoma.

The distribution of the tissues is extremely various; in some cases of soft growths (Fig. 86) the connective tissue may be seen in the form of definite trabeculæ passing from the capsule, and splitting the muscle bundles into distinct groups; these trabeculæ also carry the blood-vessels. More frequently the connective tissue and muscular bundles are indefinitely intermixed without any apparent regularity in their distribution, and according to the proportion of each so is the tumour soft or hard (Figs. 86 and 87).

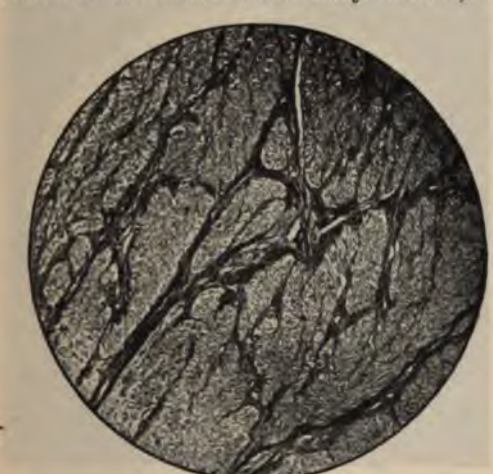

Fig. 86.—Microscopic section of soft fibromyoma, showing large muscle areas surrounded by connective tissue trabeculæ carrying the blood-vessels. × 40.

The appearances presented by the muscle bundles on section vary greatly, as is to be expected from their irregular disposition throughout the growth, running parallel as they do to the blood-vessels. When cut longitudinally, their elongated shape and rod-like nuclei are at once apparent and characteristic; on direct transverse section they closely simulate groups of round cells. When obliquely severed they may have the appearance of the cells of a spindle-celled sarcoma.

Between the muscle bundles may be seen many spaces in the connective tissue, only here and there lined by endothelium, and forming true lymph channels. Nerves terminating in the individual muscle cells have been described by Hertz.

So far as histological examination shows, it would appear that these growths originate and develop by the proliferation of muscle fibres around the capillaries, the connective tissue at the same time being slightly increased. In this manner they may continue to grow rapidly to a large size, and are known as soft tumours. In the majority of instances, however, the fibrous connective tissue would seem slowly but surely to increase at the expense of the muscular elements which it displaces; the tumour thus becomes harder and more fibrous, the blood-vessels are encroached upon and even obliterated, and the muscular cells themselves are to be recognised only in groups here and there. This fibrous tissue development tends to take place more in the older and central portions of the growth, which are less vascular than in the periphery of the tumour, this portion being more freely nourished by the vessels which everywhere pass to it from the capsule.

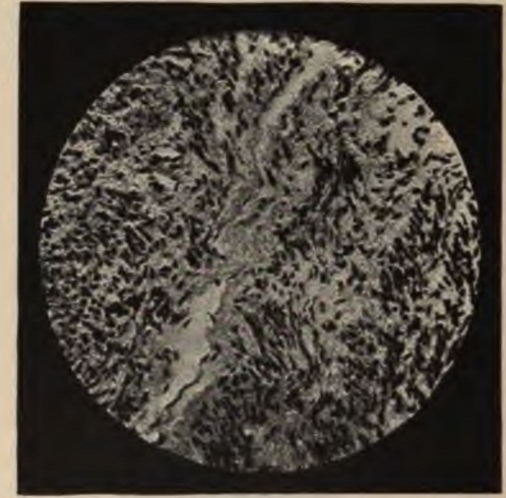

FIG. 87.—Microscopic section of common fibromyoma, showing muscular and connective tissues and blood sinus. × 120.

The rate of growth, then, must depend almost entirely on active proliferation of the muscular elements at the periphery. When the fibrous tissue predominates the increase is extremely slow, and in many cases ceases altogether; the rapidly growing tumour is largely composed of muscle, and is thus softer and more vascular than the hard, slow-growing, or even stationary type. On purely pathological grounds it is, therefore, impossible to divide these tumours into fibrous and myomatous varieties, as the one may pass insensibly into the other. The term fibromyoma must on these grounds be considered as a strictly scientific designation which embraces all varieties. From a clinical aspect, however, it is well to recognise the two types of soft and hard tumours, as they vary greatly in their rate of growth, prognosis, diagnosis, and treatment.

I have said that all fibromyomas originate in the muscular layers of the uterine wall; yet the site of their development and the subsequent direction of their growth are of the utmost importance. Their clinical aspects and subsequent course differ so much with their situation, that for descriptive purposes it is necessary to distinguish them; and for this purpose they are clinically classified as Submucous, Subperitoneal, and Interstitial (Fig. 88).

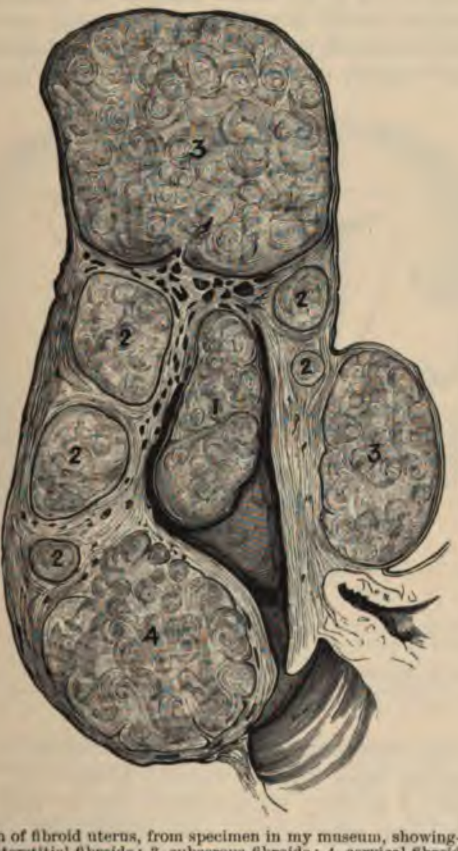

FIG. 88.—Section of fibroid uterus, from specimen in my museum, showing—1, polypus; 2, interstitial fibroids; 3, subserous fibroids; 4, cervical fibroids.

Submucous Fibromyomas.—These are represented by two varieties, distinguished by the presence or absence of a muscular capsule. The "free" or non-capsulated variety is usually developed from the internal layers of the uterine muscle, and is thus from its origin closely connected with the superimposed mucosa, which itself forms the false capsule from which the tumour derives its nourishment (Fig. 89, 1 and 1A). The encapsulated variety, on the other hand, is developed in the middle layers of the uterine muscle, and thus its false capsule is formed by muscular tissue; but at the same time, as its direction of growth is towards the uterine cavity, it bulges the mucosa in front of it (Fig. 89, 2 and 2A), and on a superficial examination seems identical in appearance with the "free" variety (Fig. 89). Though thus apparently similar,

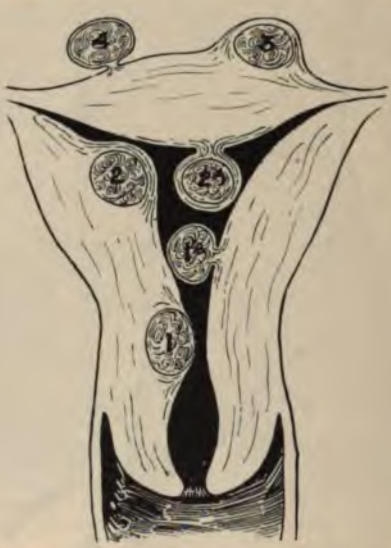

Fig. 89.—Diagram of growth of uterine fibroids. 1, 1A, Free submucous; 2, 2A, encapsulated submucous; 3, encapsulated subserous; 4, free subserous.

the modes of their subsequent growth and attachment to the uterus ar of sufficient practical importance to warrant distinction.

In some cases a primary encapsulated tumour may become "free subsequently by the attenuation and destruction of its muscular capsule by pressure.

The uterus, being highly intolerant of foreign bodies in its wall, and especially in its cavity, attempts by contraction to expel them. Thus both varieties of submucous tumours are prone to be driven more and more into the uterine cavity, and to become more or less stalked or pedunculated, so as to form what are known as submucous polypi (Fig. 90). That this process of expulsion must be easier in the free variety is evident, as there is no superimposed uterine wall or capsule to prevent it. Should pedunculation occur, the pedicle or uterine attachment must vary considerably in the two types; in the "free" variety it will be merely represented by the attenuated mucosa; in the encapsulated type the muscular capsule is continuous with the uterine muscle. In some instances the latter may become so attenuated as to offer but a feeble union with the uterus; but in many cases it remains well marked and firm. It will thus be seen that though removal of the former is usually easy, in the latter it may be an affair of considerable trouble.

The encapsulated tumours grow to a much larger size than the free; this is due to the preservation of the capsular circulation from which alone fibromyomas are nourished. I have, however, met with "free" polypi as large as a fœtal head, the growth being nourished by large vessels situated in the highly vascular mucosa; this indeed in these cases may be considered as the capsule.

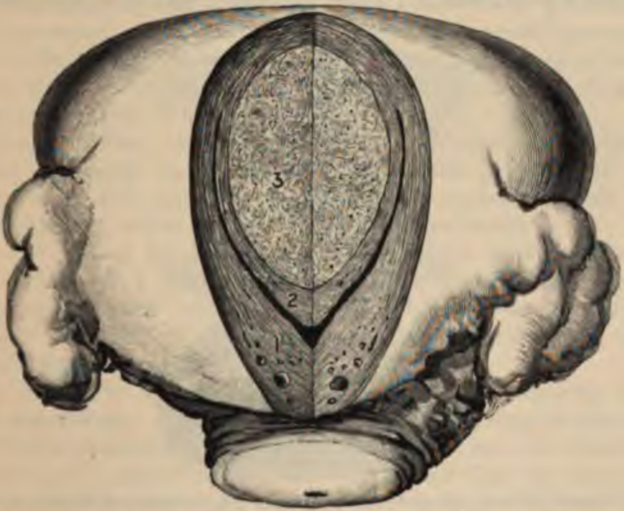

FIG. 90.—Encapsulated submucous fibroid becoming polypoidal. From specimen of injected uterus and fibroid, Anatomical Museum, Edinburgh. Half-size. 1, Uterine wall; 2, capsule; 3, tumour.

In many instances the muscular capsule resists the attempts of the uterine contractions to expel the growth; thus pedunculation is prevented, although the tumour may bulge more or less into the uterine cavity; this form is known as the true *sessile submucous fibromyoma*. A submucous polypus can be considered only as the final stage of the attempt of the womb to expel tumours primarily interstitial or submucous.

Both sessile and pedunculated varieties necessarily cause enlargement of the uterine cavity, and greatly increase the vascularity of the organ. At the same time, by stimulating the uterine contractions for their expulsion, they lead to much general increase in the thickness of the uterine wall; so marked, indeed, in some cases, is this hypertrophy, that it may closely simulate the pregnant organ in the earlier months of gestation, a similarity which has given rise to the descriptive term, *grossesse fibreuse*, used by Guyon.

Primarily the entire mucous membrane may become congested, but especially that portion which actually covers the tumour. This is well shown in the injected uterus with contained polypus in the Anatomical Museum of Edinburgh University (see Fig. 90). From this site it is probable that the copious hæmorrhages proceed which are associated with this variety of tumour.

It is averred by Wyder that there is constantly an inflammatory connective tissue thickening of the entire mucosa; in many cases which I have carefully examined, I failed to detect this process, although in others it was well marked. In certain cases a glandular endometritis is associated with fibromyoma, which accounts for the severe accompanying leucorrhœa frequently complained of.

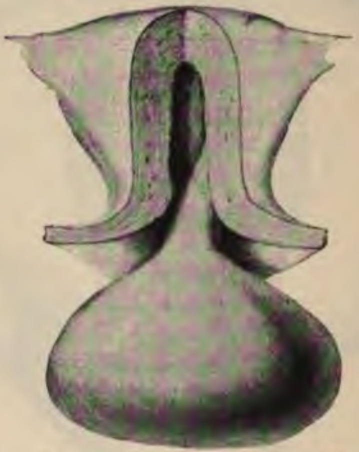

FIG. 91.—Submucous polypus. From specimen, College of Surgeons' Museum, Edinburgh. Half size.

Atrophy, and even ulceration of the superimposed mucosa, are occasionally met with as the result of pressure from extrusion of the tumour; and should the growth, as in the "free" variety of polypus, derive its nourishment from the vessels of the mucosa, grave secondary changes, such as sloughing and gangrene, are likely to result. From the compression exercised by the contraction of the uterus, the circulation through a polypus is frequently so far arrested that it becomes more or less infiltrated with serum. This, if acute, may result in death, sloughing, or gangrene; but if slow it does not entirely stop the nutrition of the polypus, though it imparts to it a soft elastic consistence which may lead to its being mistaken for a cyst (chronic œdema). Cystic change is met with, occasionally, in these tumours (see p. 299).

As the result of uterine contractions and of gravitation, all uterine polypi tend to descend towards the vagina, and their pedicles become more and more elongated and attenuated (Fig. 91). This may go so far that they may project from the vulva, though still attached to the uterus (Cullingworth). Expulsion into the vagina may be extremely sudden, but usually it is slow. In the case of the so-called "intermittent polypus" the os uteri becomes dilated at intervals, and the growth may then be felt projecting through it. This periodic dilatation is nearly always met with during a menstrual period. Complete separation and expulsion, though by no means unknown, are rarer events than might be supposed. Partial inversion of the uterus not infrequently results from the too rapid expulsion of these growths; and several cases of total inversion have been recorded.

From pressure on the surrounding uterine and vaginal mucosa, ulceration and subsequent adhesions may form; and through these secondary attachments the nutrition of the tumour may be maintained, even after total separation from its original site.

During expulsion the polypus may be gripped so firmly by the cervix as to result in a slough of the entire intravaginal portion. In these cases the gangrenous process may spread upwards through the entire tumour, when it frequently terminates fatally.

Not only, as I have said, may the uniform spherical shape, and smooth surface of a polypus, become much altered in contour from surrounding pressure and cervical constriction, but ulceration, and consequent sloughing of the capsule, may closely simulate a cancerous mass, and may be mistaken for it.

Symptoms.—The characteristic symptom of the submucous fibroid is uterine hæmorrhage. This occurs at a very early stage in almost every case, and thus this variety of tumour comes much more frequently under the notice of the practitioner at an early period than the subserous and interstitial varieties, which rarely give any indication of their presence till they have attained considerable dimensions. The hæmorrhage may vary greatly in degree; but the blood loss, as a rule, closely corresponds with one of two factors, namely, the size of the growth or the extent of its pedunculation. Thus, if a small growth the size of a walnut become polypoidal, it may give rise to bleeding as severe as that from a large sessile tumour.

In a typical case of submucous fibroid the clinical picture is suggestive and characteristic; and shows a history of slowly increasing menorrhagia, with consequent anæmia and debility. The former, at first but slight and temporarily confined to the menstrual and immediate post-menstrual period, becomes more severe and continuous; intermenstrual bleeding follows in due course, and eventually the hæmorrhage becomes almost constant, and the patient is reduced to the utmost extremity.

Variations from this extreme, though by no means infrequent course of events are often met with. The slowly increasing menorrhagia may rapidly or suddenly give place to copious metrorrhagia; and the character of the hæmorrhage may vary from a prolonged and constant oozing to sudden gushes of alarming magnitude. Floodings and copious intermenstrual bleedings are very commonly associated with polypi, and are probably due to lacerations of the veins in the pedicle. In some instances these must be looked upon as the only source of excessive bleeding, as the menstrual periods are frequently regular and quite normal in amount, except when broken occasionally, after many months' interval, by a sudden and profuse hæmorrhage. In some cases a severe bleeding from an intra-uterine polypus may be followed by amenorrhœa of some months' duration.

The source of the bleeding is twofold—from the mucosa immediately covering the tumour, and from the general lining of the uterus. Probably on most occasions they are simultaneous, but it is certain that either may occur separately.

The most active primary site of the hæmorrhage is undoubtedly the mucosa covering the growth; it is always extremely vascular, but is especially so in the "free" variety, as it contains the venous sinuses from which the growth is nourished. In some cases, where from pressure the mucosa becomes atrophied, and its vascularity completely destroyed, the menorrhagia may cease. Should bleeding, however, continue, as it most frequently does, the source of the hæmorrhage will now be found in the general mucous lining of the uterine cavity, which is usually thickened and congested as the result of irritation and increased uterine contraction. That complete atrophy and absence of vascularity of the superimposed mucosa occurs, may frequently be observed in ulceration of the lower pole of a polypus without associated hæmorrhage. The metrorrhagia is in many cases due to the rupture of veins in the superimposed vascular mucosa, a condition which accounts for the suddenness and occasional enormous amount of the blood loss. Indeed, fatal bleedings from this source have been noted by Cruveilhier and Matthews Duncan (18). As I have already shown, rupture of the venous sinuses in the pedicle of a polypus may account for those irregular and profuse hæmorrhages which may be the only indication of its presence. This is due to tearing, as the expulsive action of the uterus drives the tumour outwards.

The increased hæmorrhage at the menstrual epochs, which is associated with fibromyoma, frequently remains moderate in degree throughout the entire menstrual life of the patient, with no tendency to aggravation or to metrorrhagia. This obtains only in tumours which remain small and inactive.

Associated with the symptoms of hæmorrhage there is, in a small proportion of cases, a constant and abundant watery leucorrhœa, directly due to concurrent glandular endometritis. When present it effectually prevents the restoration of strength so necessary after a prolonged or profuse period.

Pain in this variety, as indeed in all varieties of fibromyoma, is a most variable symptom. When of considerable size, the tumour usually produces a sense of weight and bearing down in the pelvis; and frequently, from the pressure of the enlarged uterus on adjacent structures, symptoms similar to those described under the subserous variety are experienced. Retention of urine is stated by Hardie to have been caused by the pressure of a small tumour on the neck of the bladder through the anterior uterine wall. Very occasionally intense and continuous pain is present with small tumours, while with others, which may distend the uterus to the size of a six months' pregnancy, little or no discomfort is felt.

Severe dysmenorrhœa is fairly frequent, and is due either to obstruction of the flow of blood from the uterus by the tumour (mechanical), or to the uterine contractions which occur during menstruation, and which, under the influence of the tumour in its wall, are irregular and painful.

Pains of a labour-like nature are constantly associated with polypi, and are due to uterine contractions attempting to expel the growth. Reflex pains and neuroses of all varieties, and in every situation, may be present.

Sterility is common in this variety; indeed, conception seldom occurs. Should it do so, however, the continuance of gestation is usually interfered with (see p. 270).

The menopause in the majority of cases is much delayed.

Diagnosis.—The detection of submucous fibroids depends almost entirely on the history of uterine hæmorrhage, associated with physical signs of enlargement of the uterus and its cavity. The increase of the uterus as a whole is only to be made out by careful bimanual examination, when the organ will be found symmetrically enlarged to a greater or less extent, according to the dimensions of the neoplasm within. The condition may closely simulate pregnancy, but the harder consistence and the history of hæmorrhage are usually sufficient to distinguish it. Enlargement of the uterine cavity is to be diagnosed with the uterine sound, which, however, in some cases, on account of the distortion of the canal by the tumour, can be passed only with difficulty. Undue force in the attempt must be carefully avoided, as laceration of the capsule might bring about serious consequences. Therefore, if much resistance be met with, a flexible gum elastic or whalebone bougie should be substituted for the sound, and will generally be found very serviceable.

The conditions most apt to be mistaken for fibroid tumour are subinvolution, or chronic metritis with endometritis; but in these cases direct derivation from a previous pregnancy, and associated chronic cervicitis, aid us in the diagnosis. Should the distinction be doubtful, nothing remains but direct digital examination of the uterine cavity, when the absence or presence of the tumour will be ascertained. The intra-uterine examination may, in many cases, be performed easily during menstruation, when the softened and gaping cervix offers but little resistance to the introduction of the finger; otherwise artificial dilatation must be used.

Polypoidal tumours, when completely intra-uterine, are to be diagnosed in a similar manner; but being usually associated with paroxysms of "labour-like" pains and metrorrhagia, a further valuable hint in their diagnosis is afforded. Occasionally the intravaginal cervix will be found much shortened; in these cases examination during a menstrual period will seldom fail to reveal a presenting tumour, the so-called "intermittent polypus."

Submucous polypi of the body of the uterus, when intravaginal, are usually easy of diagnosis by local digital examination, as the pedicle is felt to pass upwards through the cervical canal, thus distinguishing them from cervical growths. From their large size, however, and also from adhesions to the vaginal and cervical walls, a decision is sometimes impossible.

As the result of tight constriction by the cervix, or ulceration of their capsule, polypi may become gangrenous, and emit a most offensive discharge; and the tissue of the tumour itself becomes broken down and necrosed. In this condition they are not infrequently mistaken for epithelioma; usually, however, the finger can be passed beyond the rough irregular mass, when the upper surface will be found smooth, a condition which never exists in malignant disease. Further, digital examination is seldom followed by the characteristic hæmorrhage of malignant growth.

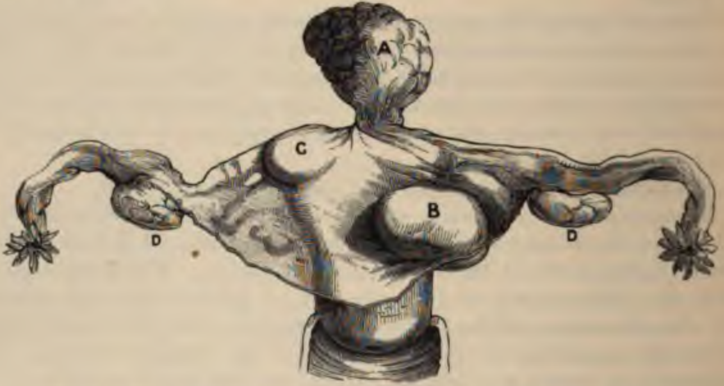

FIG. 92.—Uterus, showing subperitoneal fibroids. From specimen; half-size.

The diagnosis of polypi from inversion of the uterus can readily be made by the introduction of the sound into the uterine cavity. In the former case it will pass farther than the normal 2½ inches; if the uterus be inverted the normal length of the uterine cavity must be diminished. Careful bimanual examination will also demonstrate inversion, by the absence of the uterine body and fundus, or by the cup-shaped uterine depression.

Simple as these distinctions may appear, errors of diagnosis, leading to grave mishaps in operation, have been made by eminent surgeons (*vide* p. 216).

Subperitoneal or Subserous Fibromyomas.—In these we have a similar origin and mode of growth to the submucous, with the sole distinction that the primary fibroid nodule either originates in the external layers of the uterine muscle, and grows outwards under the peritoneum, or is developed in the middle layers, and grows, or is driven, in the same outward direction.

That there are "free" and encapsulated varieties, as in the submucous, is true; but the former rarely grow to dimensions sufficient to cause symptoms. When primarily free they seldom grow larger than a small Tangerine orange, though from attenuation of the capsule, large primarily encapsulated growths may be found apparently "free." It is probable that the slowness of growth in the "free" subperitoneal variety, as compared with the submucous, is due to want of nutrition, as the vascularity of the peritoneal covering of the former is but slight as compared with the highly vascular mucosa. The encapsulated variety, on the other hand, grows to enormous dimensions, there being no resistance to their growth comparable to that met with by the submucous, which has not only to distend the uterine cavity, but also to withstand the compressing force of uterine contraction.

Their attachment to the uterus naturally varies within wide limits; but usually in tumours of large size it is of considerable thickness; cases are not uncommon, however, where large growths have pedicles no thicker than a goose-quill. In certain instances the pedicle is so attenuated that without any apparent cause the tumour may become completely separated from the uterus. When the pedicle is long and thin, such a degree of mobility, independent of the uterus, may be obtained, that in their signs these tumours may closely simulate ovarian tumours; frequently, indeed, they are so regarded till laparotomy makes the diagnosis clear. This difficulty in diagnosis is still further increased when secondary cystic degeneration is present, a variety of change frequently met with in stalked subperitoneal tumours. Fortunately the direction of growth of large subserous tumours is most frequently upwards into the abdominal cavity, although in some instances they remain pelvic, either by accidental incarceration or by burrowing among the tissues of the pelvis with consequent splitting of the layers of the broad ligaments; this most serious condition is generally met with in tumours which spring from the lower part of the uterine body or supravaginal cervix.

Subperitoneal fibroids are usually associated with more or less enlargement of the uterus, though the degree of it necessarily depends on the extent of the attachment of the growth. However, I have seen a tumour weighing over 7 lbs. attached by a narrow pedicle to a uterus more atrophied than enlarged. Thorburn describes a similar case. From a small atrophied uterus he removed a tumour of 12 lbs. In a similar manner the cavity of the uterus is more or less enlarged according to the degree of attachment of the growth. With a narrow pedicle this may be but fractional, and after the menopause the cavity may be found actually shortened, though a large tumour be present. Large tumours attached to the fundus may, by traction from upward growth, enormously increase the length of the cavity, and at the same time attenuate the uterus as a whole. Such a case has been described by Tinns, where the uterus was so pulled out that it was represented by a mere muscular cord, the canal being completely obliterated for a distance of two inches. Virchow avers that traction may be so extreme that complete separation of the body from the cervix may occur.

From local peritonitis and subsequent adhesions secondary attachments may arise; these have been known to be the sole means of nourishment of large tumours which, through laceration of the pedicle, have become separated from their original site of development.

The position of the uterus is much modified by subserous growths: as I have said above, it may be drawn up; in other cases, however, the increased weight may cause prolapse. Other displacements naturally occur according to the position of the growth. If the tumour be large and pelvic, and lie posteriorly, the uterus may be tilted upwards above the symphysis pubis as in hæmatocele; while if small and growing from the fundus, retroflexion is a common consequence. In a similar manner, when the tumour is laterally placed, the uterus may be pushed to one side.

Symptoms.—This variety of fibromyoma, unlike the submucous, has no characteristic symptom, and in many instances grows to considerable dimensions without causing the slightest inconvenience. Frequently even large tumours of this description are casually found on examination of the abdomen for symptoms in no way referable to the pelvis. When symptoms due to their presence are complained of, these in the majority of cases are the result of mechanical effects upon the uterus or adjacent structures. Thus when small the growth may cause displacements of the uterus, with their associated discomforts—many flexions and versions of the organ are due to this cause; when larger, they give rise to pressure symptoms which vary with their size and position.

By far the most frequent and important symptoms are the effects of pressure on the urinary system, which may be affected in many ways. Thus derangements in micturition are extremely common, and vary with the site and size of the tumour. If seated on the anterior wall of the uterine body they tend to prevent easy distension of the bladder, and from their weight cause frequent micturition. When situated low on the anterior wall they early give rise to extremely painful and distressing bladder troubles, such as difficulty in urination, or even complete retention. When large and incarcerated in the true pelvis, they not only tend to give rise to severe bladder discomforts, such as urinary retention, dysuria, and cystitis, but from pressure on the uterus may cause renal complications of the most dangerous character. Cases have been recorded where suppurative pyelitis and albuminuria were cured after the removal of fibroids (Cabot, Porak, Skene); and doubtless in many cases kidney complications, whether detected or not, may account for fatal results after operation, as shown by Pozzi. In all cases of large fibroids examination of the urine should be made.

Pressure on the rectum, though more uncommon, may cause obstinate constipation and severe tenesmus. Interference with the pelvic circulation, from pressure on the veins, may be associated with hæmorrhoids, varicose veins of the vulva, and occasionally, if exaggerated, with œdema of the lower extremities.

From the increased vascularity of the pelvis due to the presence of the tumour and the associated impairment of venous return by increased intra-abdominal pressure, a bluish discoloration of the vulva analogous to Jacquemier's sign of pregnancy may frequently be noted.

Pressure on the sacral nerves is frequently associated with agonising pains in the back and legs; while irritation of the sympathetic ganglia may cause vomiting and other reflex neuroses of indefinite characters. It will thus be evident how terrible may be the sufferings from a large intrapelvic fibroid.

Compression and irritation of the peritoneum may cause circumscribed peritonitis, with subsequent adhesions; in some rare cases ascites has been noted. Sloughing and gangrene of the pelvic soft parts may occur from incarcerated tumours. Fortunately, the tendency of subperitoneal tumours is to grow upwards into the abdominal cavity; yet here, according to their size and position, they may give rise to pressure symptoms of more or less severity. Usually these are extremely slight, unless the tumour be of enormous dimensions. When freely movable, severe sickness and other reflex phenomena may be complained of. Cardiac weakness is frequently present as the result of prolonged anæmia, specially in submucous tumours, but in large growths without marked hæmorrhagic symptoms it is seldom present.

Uterine hæmorrhage, the outstanding feature of the submucous variety, is but seldom present with subserous growths; however, in some cases, from associated pelvic congestion, metritis and endometritis, or the presence of other small fibroid nodules dwarfed by the large growth, bleeding may form a marked symptom.

The *diagnosis* of subperitoneal fibroids is at times extremely simple; on the other hand, it may be surrounded with difficulties which make absolute certainty impossible. This is in great part accounted for by the absence of any specific symptom or sign, such as the hæmorrhage and the uterine enlargement which we find in the submucous varieties. As we have already seen, the uterus may or may not be enlarged; in like manner, hæmorrhage, both menorrhagic and metrorrhagic, is as frequently absent as present: indeed, the symptoms of a given case may simulate those of other pathological conditions, which indeed often present almost identical physical signs. In some cases it is only by careful bimanual palpation that the presence of a growth can be recognised; and in many cases a differential diagnosis, even in the hands of most competent observers, can only be provisional.

For the sake of simplifying the diagnosis it may be well to classify these growths as of three types:—

1. Those of the fundus and anterior and posterior walls of the body of the uterus, which tend to become pedunculated and to grow upwards into the abdominal cavity. 2. Those of the side walls of the uterus, which split the layers of the broad ligament. 3. Those of the lower part of the uterus, which grow downwards into the pelvis—incarcerated tumours.

The diagnosis of large tumours of the first group is usually easy when the attachment to the uterus is well marked; for by the bimanual examination their origin from the uterus can be distinctly felt, and the two structures will be found to move simultaneously. When the pedicle of attachment is long and thin the diagnosis is much more difficult, as the uterus may be moved independently of the growth. When small it may sometimes be difficult to decide, by simple palpation, from which wall of the uterus a tumour springs, as the tumour and the fundus may appear similar in size and consistence. In these cases, however, the passage of the sound into the uterine cavity will decide the matter at once.

A small growth on the posterior uterine wall is most easily palpated by rectal examination with simultaneous dragging downwards of the uterus by means of a volsella. In this situation a small fibroid may be mistaken for an ovary prolapsed and fixed in the retro-uterine pouch; by a similar method of examination the absence of tenderness on pressure, and the presence of the ovaries in another situation, can be ascertained, and the exact condition determined.

When associated with surrounding inflammatory deposit, the diagnosis of small fibroids is extremely difficult and often impossible.

Occasionally small tumours of the lower part of the anterior uterine wall are extremely difficult to detect, though, nevertheless, they may give rise to most distressing urinary symptoms. Digital examination by the urethra should be practised in these cases, as in many a differential diagnosis can be obtained by this means alone.

Increase in the size of the uterine cavity is usually present when the uterine attachment of the tumour is well marked, although in rare cases large tumours have been found with a distinctly atrophied uterus.

When situated between the layers of the broad ligament and fixed, and at the same time displacing the uterus to one or other side of the pelvis, these tumours may be confounded with morbid *tubal enlargements* or *cellulitic deposits*. Under these circumstances the history of the case, the even contour of the mass, and the comparative absence of pain on pressure, tend to remove the obscurity in diagnosis.

Tubal gestation, with a history of irregular and profuse uterine hæmorrhages, may be distinguished by the softness of the uterus and the attached swelling, the rapidity of its development, and the presence of other signs of pregnancy.

Hydro-, pyo-, and hæmatosalpinx, when matted by adhesions and surrounded by inflammatory exudation, may present a great resemblance to a tumour. But the absence of tenderness on pressure and the enlargement of the uterine cavity will assist greatly in forming a correct diagnosis. Cellulitic deposits are frequently to be distinguished only by the history of pain and fever, and by their diminution under suitable treatment. From the projection of the tumour, when large, into one or other iliac fossa, where it is immovably fixed, it might at first be mistaken for a growth of the ilium. This mistake will, however, be rectified on pelvic examination, which will reveal its connection with the uterus.

Large abdominal tumours are frequently associated with a marked uterine souffle, and may thus, from their shape and median position, resemble the *pregnant uterus.* But the absence of amenorrhœa, slowness of growth and harder consistence, with a coexisting want of mammary and other symptoms and signs of pregnancy, should prevent any serious misapprehension.

From *ovarian growths* fibroids are usually to be distinguished by their harder consistence; yet I have seen a unilocular parovarian cyst so tense that differentiation by this means was impossible. Other points of differential importance—such as uterine hæmorrhage, uterine souffle, increased size of uterine cavity, and the nodular outline of the tumour—may, in individual cases, assist us in arriving at a correct conclusion as to the nature of the growth; unfortunately these, one and all, are as frequently absent as present. When it has undergone secondary cystic change, the difficulty of diagnosis of a fibroid from an ovarian cystoma is still further increased, and in many cases laparotomy alone can decide the matter.

Solid ovarian fibroma, from its rarity, may usually be set aside; moreover, in the majority of cases, this is associated with ascites, a condition rarely met with in uterine fibroids.

Subperitoneal tumours which grow downwards into the pelvis are fortunately rare, and probably arise in the majority of cases from the supravaginal cervix, to which they are closely attached. They usually retain a broad attachment to the uterus, and from their position early give rise to severe and distressing pressure symptoms.

As has already been shown, fibroids are extremely difficult to diagnose when small. When posterior, they tend to lift the uterus upwards behind the pubic symphysis, and at the same time they fill up the recto-uterine and recto-vaginal space, where they may be felt as a hard fixed mass, bulging the posterior fornix and posterior vaginal wall. They may be closely simulated by incarcerated subperitoneal tumours; but these are usually more or less movable on pressure, and present a distinct sulcus between the uterus and the growth. In most cases tumours which arise low in the uterus tend to shorten the infravaginal cervix; by this property they can usually be diagnosed from the incarcerated fibroids of the upper part of the uterine body and fundus.

Interstitial Fibromyomas.—The primary nodule in this variety always originates in the middle layers of the uterine muscle, but has no special tendency to grow or to be driven in any one direction. Thus when of any size, it is surrounded on all sides with a layer of uterine muscle of equal thickness which forms the capsule; it may be practically considered, therefore, as a simple localised thickening of the uterine wall.

These growths form a connecting link between the submucous and subperitoneal varieties, the characters of either of which they may secondarily assume, as already described. They produce the effects of both varieties on the size and position of the uterus; simulating on the one hand the submucous, by causing enlargement of the uterine cavity, and at the same time, if of large size, displacing the organ after the manner of the subperitoneal. It will thus be seen that an absolute distinction between the described varieties is impossible, as the one drifts insensibly into the other. For clinical description, however, the classification is useful. The growth of the intramural variety is disposed to be more rapid, as its nourishment from the highly vascular capsule is less liable to be interfered with than in the other forms. From their freer circulation and more rapid growth they are usually more highly myomatous than the other varieties, and have thus a softer consistence. Hard fibrous nodules are also very commonly met with.

Their direction of growth, though frequently abdominal, is prone to be intraligamentary and pelvic. They tend, therefore, soon to give rise to pressure symptoms. They may attain enormous dimensions in a comparatively short time, and are particularly liable to secondary œdematous changes. Fibroids are usually multiple, and examples of each variety may be simultaneously present in the same uterus, each more or less masking the characteristics of the other. It is by no means uncommon to find a submucous polypus associated with large growths, both peritoneal and interstitial. It is, in fact, the exception for them to grow singly.

Symptoms.—Being the connecting link between the subperitoneal and submucous forms, the symptoms of intramural growths are more or less a combination of those of both the former. Thus on the one hand, like the submucous, they frequently give rise to hæmorrhage, dysmenorrhœa, or leucorrhœa; and at the same time they are associated with the marked pressure symptoms characteristic of the subserous. It must be mentioned, however, that hæmorrhage, though a common symptom of this variety, is by no means invariably met with, even though the tumour be of large size and associated with great enlargement of the uterine cavity.

Being always surrounded by a well-marked vascular capsule, from which the nutrition of all fibromyomas is derived, they naturally tend to grow with greater rapidity and to reach larger dimensions. When large, they may be associated with a marked uterine souffle. When extremely small, their symptoms and signs are practically identical with those of metritis and endometritis, namely, hæmorrhage, with enlargement of the uterus and its cavity; and from these it is impossible to distinguish them (*vide* p. 258). When of considerable proportions, the regular globular increase of the uterus can be made out without difficulty. Such tumours may now be mistaken for submucous growths; but usually the hæmorrhage is not so severe, and the sound passes into the uterine cavity without difficulty. If any difficulty in diagnosis should remain, digital examination of the uterine cavity after cervical dilatation will at once decide the matter.

With small tumours, the uterus, from increased weight, is low in the pelvis; but when larger than a four months' pregnancy, the uterus is pulled up, and the vagina elongated.

From the presence of a uterine souffle, and the frequently associated blue discoloration of the vulva, these tumours may at first sight be mistaken for pregnancy; but this error should at all times be easily avoided by having regard to the menstrual history, the rate of growth, the consistence of the vagina and of the tumour, and the absence of mammary changes.

Fibromyoma of the Cervix.—As has already been noted, cervical fibroids are much less frequent than those of the body and fundus uteri; and though in this situation they are identical with the latter in their development and mode of growth, their clinical character is so distinct as to require separate description.

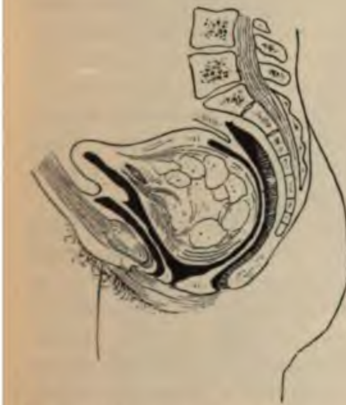

Fig. 93.—Submucous intravaginal cervical fibroid. (After Schroeder.)

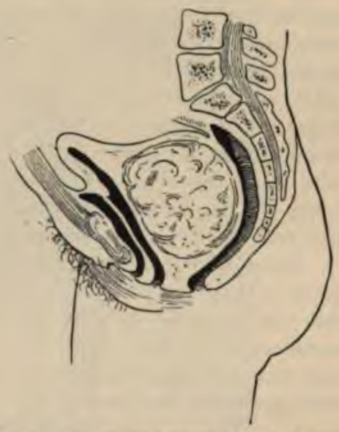

Fig. 94.—Subserous cervical fibroid, tilting uterus above pubes and bulging posterior vaginal wall.

As Duchemin has shown, an interstitial nodule of the uterine body from a downward direction of growth may become secondarily entirely cervical. At the same time, a tumour by growth upwards and downwards may combine the characteristics of the cervical and corporeal varieties. I had a well-marked example of this class under my own care, where a tumour distinctly felt at the level of the umbilicus was protruded at the same time through the vulva. On account of its enormous dimensions, removal by morcellation was performed, as it was expected that two growths might be present—the one a large submucous polypus, and the other interstitial or subserous. After removal, however, of the vaginal portion, the anterior cervical lip was found tightly stretched over the tumour, which formed one mass, involving the posterior cervical lip and the posterior wall of the uterine body.

Cervical fibromyoma may be submucous, interstitial, or subserous.

The *submucous* varieties may be stalked or sessile, and they usually project into the vagina. They are rarely bigger than a goose egg, but they may be large enough to fill the whole true pelvis (Fig. 93). They tend to cause prolapsus uteri, and may closely simulate inversion of the fundus, the os uteri being frequently most difficult to find. They are rarely found to grow from the vaginal aspect of the free cervix.

When *subserous* they necessarily arise from the supravaginal cervix, and burrow amongst the pelvic tissues, in which they become immovably fixed; thus at an early stage they may give rise to grave and distressing pressure symptoms. They are most frequently met with posteriorly, and may burrow downwards between the vagina and rectum, so as to be felt on examination bulging the posterior vaginal wall (Fig. 94). In some cases where the tumour is larger, the uterus is tilted high above the symphysis pubis, and the cervix may be quite out of the reach of the examining finger in the vagina. They also grow laterally between the layers of the broad ligament; here they are usually sessile, though stalked examples have been described in this situation by Gemmel and Mallet. They rarely fill the utero-vesical space, but when in this position they soon give rise to extremely distressing urinary trouble.

Interstitial cervical fibroids are extremely rare. From their fixed position they completely obliterate the vaginal fornix, and so stretch and thin the opposing cervical lip that frequently the os uteri is only to be made out with the utmost difficulty as a narrow slit. The utero-vaginal relations are thus completely altered, and on examination the vaginal roof appears to be blocked by a hard resistant mass, with the free cervix absent. The os uteri may be difficult to detect, but is frequently represented by a large transverse slit, the cervical lip not involved being stretched over the growth (Fig. 95).

From the growth of the tumour in this situation displacement of the bladder and fundus uteri may be met with. This gives rise early to pressure symptoms, especially if situated in the anterior cervical lip.

When submucous, they are generally associated with much leucorrhœa and feeling of pelvic weight; but, being free from the uterine cavity, they seldom give rise to the hæmorrhages which characterise polypi of the uterine body. They may, however, cause severe dysmenorrhœa from obstruction to the menstrual flow.

When small, their diagnosis is self-evident; but when large and filling the vagina, their attachment is often impossible to trace, and they may thus be mistaken for fundal fibroids with inversion, as a thorough bimanual examination of the uterus and the use of the uterine sound are impossible. From their occasional broad attachment, involving the entire lip of the free cervix, they appear to rise directly from the vaginal wall, and have been mistaken for vaginal fibromyoma.

Treatment.—When submucous and stalked, their removal is to be erformed in the manner described for polypi. When sessile, their nucleation is usually an easy matter.

When interstitial or subserous, however, their removal is by no means simple. In this position they are usually slow in their growth, and I have seen several cases where they seemed to undergo no change, and remained innocuous during several years.

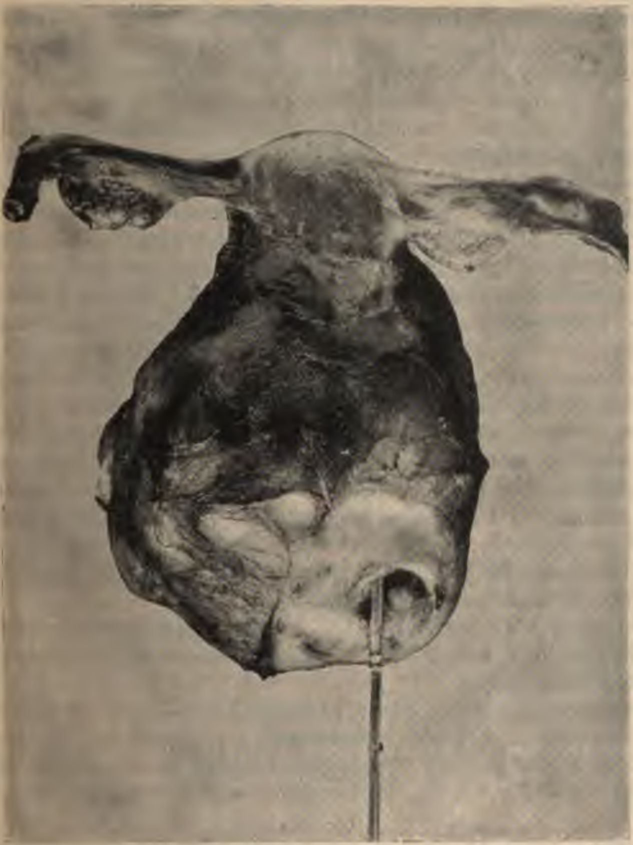

FIG. 95.—Photograph of interstitial cervical fibroid. Sound introduced through dilated os externum.

If, however, symptoms indicate pressure, only absolute removal is of any value, so far as my experience goes. Electricity and ergot are practically valueless.

Extirpation of the growth by enucleation or morcellation per vaginam, as described on p. 800, can be performed, but complete hysterectomy by the abdominal method is perhaps the most satisfactory treatment. From the close neighbourhood of the ureters, and the embedded position of the growth, the operation is of considerable difficulty, and demands much care. As the bladder and fundus are displaced the usual landmarks are difficult to recognise.

Growth and course of Fibromyoma.—The rate of growth of fibromyomas is extremely variable. In many carefully observed instances they have been known to remain for years practically stationary; while in others large tumours have been known to develop within a few months. In general, however, their growth is comparatively slow. Their rate of increase is naturally proportionate to the means of nourishment; and as this is entirely derived from the vessels of the capsule, it necessarily follows that completely encapsulated tumours, such as the interstitial, tend to grow much more rapidly than those in which the capsule is partial, or atrophied from pressure. In like manner, tumours which are free from pressure develop more rapidly, which accounts for the usually large size and more rapid growth of the subserous and interstitial varieties as compared with the submucous. Sudden and rapid enlargement may occur; but this is usually due to secondary changes, such as œdema, or hæmorrhage into the substance of the tumour. Temporary enlargement, due to increased vascularity, is manifest during menstruation and pregnancy; but it is probable that during the latter event a certain increase remains, although, in many examples, involution and uterine contraction during the puerperium cause some retrogression.

After the menopause active growth commonly ceases, and the tumours tend to atrophy, or at least to remain quiescent; rapid enlargement may, however, occur after this period as the result of secondary changes.

On account of the increased vascularity of the uterus due to the presence of tumours, the menopause is usually delayed. Thus active growth may continue till the patient is well over fifty years of age, a point of great importance in prognosis.

The change which occurs in the tumour after the climacteric is one of progressive induration, due to atrophy of the muscular elements from diminished blood-supply.

Secondary Changes.—These, as they affect the size of the tumours, may be considered as either retrogressive or progressive. The former are represented by atrophy and degeneration—fatty or calcareous; the latter by œdema, cystic formation, inflammation, and infiltration by embryonic cells.

Atrophy.—This, the usual event after the menopause, may occur during the sexual period, and may extend from a slight diminution in size to complete disappearance of the growth. This event, though rare, has been noted by such close and competent observers that no doubt of it exists. Thus Bantock relates an interesting example in the *British Gynæcological Journal*, and Schroeder (55) has collected and observed a large number of cases.

Slight diminution is, in the vast majority of cases, associated with evident hardening of the tumour, and is due to the excessive development of the fibrous tissue at the expense of the muscular; a process induced by diminution in the blood-supply, which may be due either to excessive pedunculation or to pressure.

The process by which actual absorption is brought about is more difficult to determine. It is probable that, in some cases at least, œdematous infiltration may be the precursor of such a result; for the softening of the tissues generally, the associated swelling and degeneration of the individual cells, and the disappearance of their nuclei, point to a retrogressive change which may lead to complete obliteration.

The probable factor in the production of the œdema is a contraction of the muscular wall of the uterus, which, from compression of the tumour, interferes with the lymph return. This probability is strongly supported by the fact that, in the majority of cases recorded, the absorption occurred after pregnancy or subsequent to treatment by electricity, ergot, or removal of the ovaries, all of which means are undoubtedly associated with much uterine contraction. Thoroughly encapsulated tumours are therefore more readily influenced in this manner. Further proof of the effect of excessive contraction of the puerperal uterus is to be found in the many cases cited where sloughing of the tumour has followed delivery.

Calcification is due to the deposit of carbonate and phosphate of lime in the fibrous tissue of tumours which have ceased to grow, and gives rise to the so-called "womb-stones." It is most frequently met with in the tumours of elderly women, in which after the menopause atrophy and induration have supervened. When present before the menopause, which is unusual, it is generally found in stalked subserous growths in which the means of nourishment are extremely slender. In elderly women, however, all varieties of fibromyoma are liable to this change. Calcification may be present in either of two forms, peripheral or interstitial. In the former and rarer variety, a thin rough chalky deposit is found on the surface of the growth only; in the latter there is an infiltration of lime salts throughout the thickness of the growth; the salts may be deposited in patches or invade its mass. So dense may this deposition be that the surface of the cut sections can be polished like ivory. When peripheral calcification is complete, the centre of the tumour usually becomes necrotic from the complete arrest of its circulation.

Many examples of the interstitial type have been described; the submucous are but rarely met with; one of the largest calcified tumours described weighed 2 lbs. 5¾ oz.,[1] and was found in a grave, within the pelvis of an apparently elderly woman.

These calcified tumours were known and described by Hippocrates and other ancient authors; in modern times records of 51 published cases have been collected by Cruveilhier. According to some authors, the secondary change is an ossification, and the presence of true osteophytes has been observed by Freund. In the majority of cases, however, it is mere calcification. I have removed a subperitoneal calcified fibroid weighing 2 lbs. from a woman of 72 for painful pressure symptoms. The atrophied uterus was attenuated to the thickness of a goose quill.

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[1] Spec. 1799, Edinburgh Anat. Museum.

Fatty degeneration is of extreme rarity. Examples, however, are described by Turner and Hewitt (66); and a specimen, described by Sir James Paget, is to be found in St. Bartholomew's Museum (Series 33, No. 74).

Lardaceous degeneration is described in a unique case quoted by Stratz.

Colloid and Myxomatous changes, on the other hand, are comparatively frequent; but as they are intimately associated with the cystic changes later to be described, consideration of them may be deferred.

Malignant degeneration and infiltration of fibromyoma is entirely confined to the connective-tissue or sarcomatous type; it is probable, indeed, that all encapsulated sarcomas were originally fibromyomas. Carcinoma never occurs in fibroids.

Spontaneous sloughing, or "necrobiosis," as it is termed by some authors, has been met with, either partial or complete, and unassociated with septic influences or gangrene; it is due to a sudden and complete arrest of the circulation through the tumour, resulting from a twisted pedicle or sustained compression. When due to the former, it is associated with symptoms of pain, fever, and peritonitis, similar to those occurring with a twisted pedicle in ovarian tumours. True gangrene, however, is much more frequent. This is particularly apt to occur in submucous growths which, after the complete arrest of their circulation by uterine contraction or cervical constriction, become exposed to the influence of septic organisms entering by some ulceration or abrasion in the capsule. In this manner complete and rapid disorganisation of the tumour results; the growth may be slowly expelled. The expulsion is always associated with a vaginal discharge of an intensely fœtid character. In many instances the termination is favourable to the patient, although, of course, death may ensue from general septic infection. Artificial attempts to bring about this natural process of cure by destruction of the capsule have been made, although generally with most disastrous consequences. The term necrobiosis has been applied by Fairbairn and others to a degenerative change, associated with a dark purplish discoloration of the tumour, which is probably due to an interference with the venous return. This will be subsequently considered in connection with cystic changes.

Suppuration and abscess formation is the most frequent result of ulceration or destruction of the capsule, whether due to such interference as curettage, or the introduction of tents or other instruments for diagnostic purposes, or to natural causes. It may, however, occur rarely in subperitoneal and interstitial tumours, where no external interference can be ascertained. Examples of such have been recorded by Lee, Lisfranc, and Jonas; and in a case of Bernays, treated by laparotomy, the enormous amount of six gallons of pus was evacuated from a subperitoneal growth. That true suppuration can occur without direc inoculation by organisms is perhaps contrary to the weight of presen pathological teaching; it is important, therefore, carefully to examin the pus in those obscure cases, in order to ascertain the presence o absence of organisms. A number of cases have been recorded by Ha and others in which suppuration of fibroids occurred during the puerperium, a result, no doubt, of septic absorption from the placental site, or from bruises caused during labour.

Cystic changes in fibromyoma.—Whether from a pathological or clinical aspect, the fibrocystic varieties of uterine tumours are most interesting. On the one hand, their clinical course and physical signs are often so variable and ill-defined that they baffle detection, even at the hands of the most competent diagnostician; while their development and structure have been, and indeed still are, the theme of fruitful discussion amongst pathologists.

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Though the detailed pathological appearances may have various minor differences in individual cases, the infiltrative varieties are characterised by a primary serous infiltration and associated myxomatous softening of the growth, accompanied by an œdematous swelling of the connective tissue, followed by more or less disintegration. When advanced, these changes result in the formation of spaces or false cysts filled with fluid, the walls of which are formed by the non-disintegrated portion of the tumour. At this stage the muscular bundles, being still present, prevent the formation of large cavities, and give to the cyst wall a peculiar uneven appearance, closely simulating the cardiac cavities with their columnæ carneæ. Subsequently, however, the muscle also becomes disintegrated and large spaces are formed (Fig. 96). The contained fluid in the large cysts varies from a pale amber to a dark porter colour, the change in colour being due to the extravasation of blood. In most instances the fluid on evacuation spontaneously coagulates; this is due to its highly albuminous nature, the exuded serum being highly charged with the products of tissue disintegration. Chemical and microscopic examination show it to contain serum-albumen and fibrin, with more or less mucin, blood, and detritus from degenerated tissue. In the early stages the fluid is almost entirely composed of serum-albumen.

The degenerative process may be confined to definite portions of the tumour, with intervening areas of higher grades of tissue; but in some instances the disintegration is so complete that a unilocular cavity is formed, bounded only by the pre-existing capsule of the tumour (Rieux).

In the early stages the cut surface may have a checkered appearance, some portions having the characters of an ordinary fibromyoma, others showing softened areas of apparently myomatous tissue, while dotted here and there may be seen small cysts, varying in size from a pin-head to a grape. In other instances the entire growth is uniformly softened, and from its surface there exudes on section a clear yellowish fluid, the escape of which causes a marked diminution in the size of the tumour. In this stage these growths are described as œdematous fibroids. In a somewhat more advanced stage a number of cavities filled with fluid will

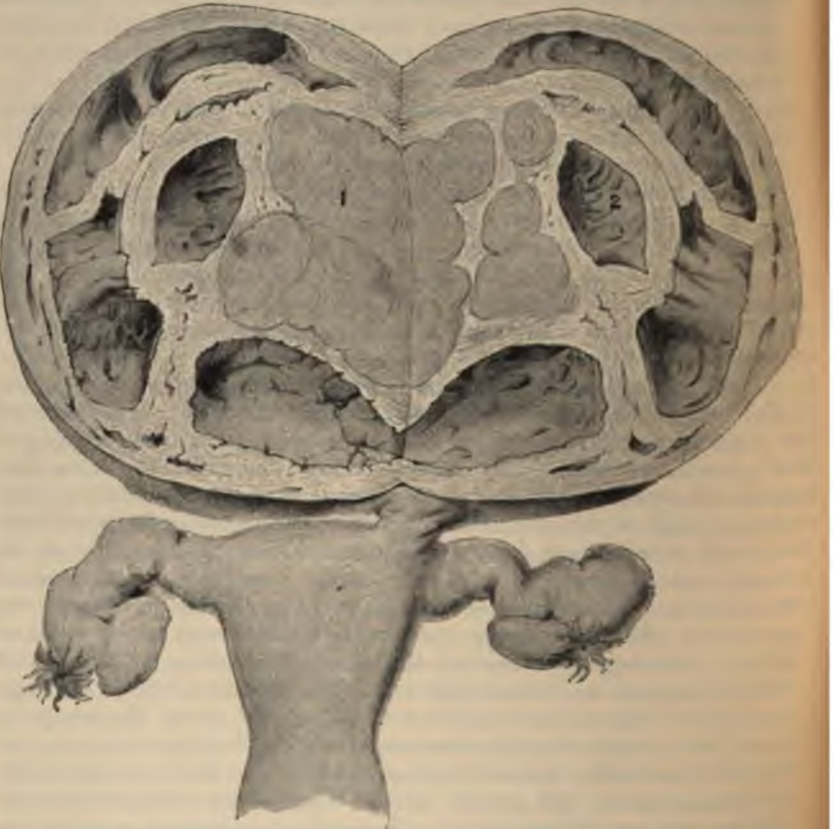

FIG. 96.—Advanced fibrocystic degeneration of stalked subperitoneal fibroid, with partially twisted pedicle. From preparation. Half-size. Showing partial degeneration and ventricular appearance of cyst wall.

be seen scattered throughout (Fig. 97). The entire growth may with great ease be enucleated from its surrounding capsule.

Microscopically, in the early stages, the structure is seen to be fibromuscular; the intermuscular fibrous and connective tissue is swollen and myxomatous, while the intercellular spaces are distended with fluid. Leopold and Fehling, and Rhein, have described an endothelial lining to the walls of the dilated intercellular spaces, which they recognised as lymph channels, and accordingly designated the tumour cysto-lymphangiectodes; but in cases described by Gusserow (26) and Spiegelberg no such lining was apparent. Of five well-marked examples which I have carefully examined, in only one have I found evidence of spaces lined with endothelium, and in this one but a few small patches scattered throughout a large tumour (7 lbs.) (Fig. 98). Examination of the cyst wall of advanced cases failed to show any true lining. In two cases of very rapidly growing interstitial tumours of this type, the microscope showed a large number of round and spindle-shaped cells situated between the bands of muscle fibres; while throughout the entire mass were isolated large round cells of an endothelial character. In all the cases examined blood extravasations were found scattered through the growth.

From the appearances presented there is but little doubt that in these tumours we have to deal with a serous infiltration or chronic œdema of pre-existing fibromyoma, which results either in a simple degeneration of a myxomatous nature, with disintegration and cyst formation, or is associated with active connective-tissue cell proliferation. This latter, from its appearance, seems to border on malignancy; and it is probable that some such tumours may become myxosarcomatous; but in the majority of cases they are unlikely to give rise to secondary growths, and they do not tend to recur after removal. It is almost certain that the cause of both varieties is the same, namely, interference with the lymph return —a condition by no means difficult to account for when one considers the usual sluggish circulation of fibroids generally: this view is corroborated by the constant appearance of areas of blood extravasation throughout the œdematous tissue. The process must then be regarded as one of chronic œdema.

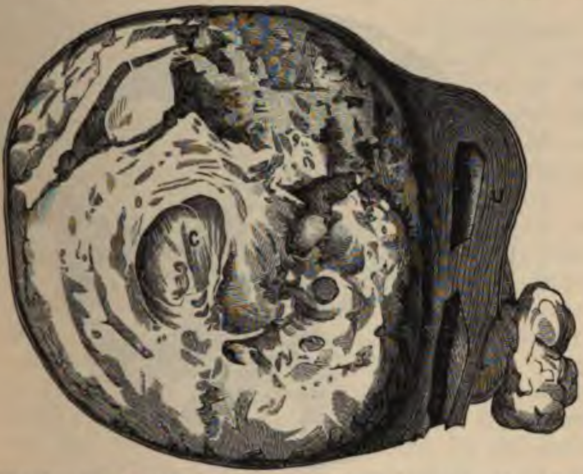

FIG. 97.—Œdematous interstitial cystic fibromyoma. Drawn from preparation. One-third size. U, Uterus enlarged to 7 inches in cavity; C, cyst in tumour.

That this obstruction is more complete in some cases than others, accounts for the colour presented by the growth, which varies from a light pink to a deep purple, and is due to a hæmatin staining, the result of blood extravasation. In the latter case it is associated with chronic impairment of the venous return, and one never fails to find dilated veins scattered throughout the growth; they are most marked in the capsule and immediately underneath it. The microscopic appearances present a degeneration of the muscular and fibrous tissue cells, with a breaking up and, finally, absolute destruction of their nuclei, a transformation analogous in all points to that known by pathologists as infarction, which is met with in the spleen and kidney. The term necrobiosis used by Fairbairn for this condition is therefore misleading and not strictly correct. The same author points out that clinically it is associated with tenderness of the tumour. This, naturally, is to be accounted for by the swelling of the tumour within its capsule, giving rise to tension. Simple œdematous change comparatively frequently occurs. I have met with fifteen cases in 100 tumours removed by hysterectomy. On the other hand interruption of the venous retur is rare.

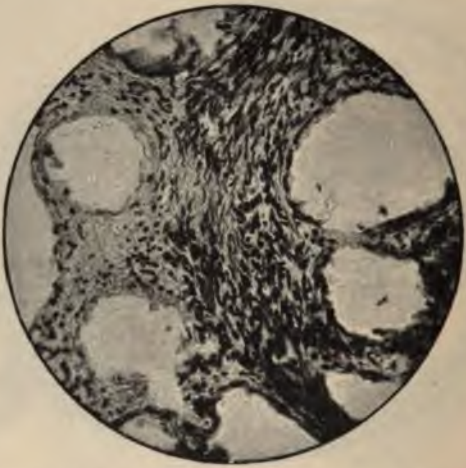

FIG. 98.—Microphotograph of œdematous fibroid, showing endothelial-lined spaces. × 180.

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Impairment of the circulation may also be met with in stalke subserous tumours as the result of obstruction to the circulation in th pedicle. This is beautifully demonstrated in the preparation from which Fig. 96 was drawn. In such cases large cysts may be rapidly formed and extensive hæmorrhages occur. In submucous polypi œdema is of course extremely common, but their expulsion is usually completed before large cysts are developed, or, sloughing and gangrene occur from subsequent complete arrest of the circulation.

From a clinical aspect fibrocystic tumours are extremely interesting. In the early stages they have a soft, boggy consistence which is apt to be mistaken for fluctuation. In the later stages, when large cavities are present, fluctuation may be made out; though from the thickness of their walls this is by no means definite, even when the cavities are of considerable size. The entire tumour may become disintegrated and form a unilocular cyst, as seen in Fig. 99, which I removed from a young woman of twenty-six.

Large cysts are specially likely to occur in pedunculated subserous growths; indeed, in fifty cases collected by Heer, five only were interstitial and two submucous. Coussat describes a fibrocyst of the cervix. Cullingworth (13) describes a similar condition in which the tumour weighed over 6 lbs., and developed rapidly after the menopause. On the other hand, in interstitial tumours simple œdematous change without the formation of large cavities vastly preponderates. As I have already pointed out, this change is almost always met with in solitary tumours; although in one case I observed small secondary nodules in the uterine wall. Their growth is more rapid than that of simple fibroids, but usually slower than that of a glandular ovarian cystoma; however, there are many exceptions to this rule. They may attain an enormous size; examples of 80 lbs. weight have been recorded. Again, they may rapidly assume large proportions from the occasional rupture of large vessels in their interior. In a case cited by Routh several such ruptures were said to have been distinctly felt by the patient. The sudden and definite enlargement from hæmorrhage, common in these tumours, may be also met with in ovarian cysts.

Cystic degeneration may occur at any age, and the subsequent growth of the tumour seems to be uninfluenced by the ovaries. Thus cystic and œdematous tumours may first give indications of their presence after the climacteric; moreover, they are in no way influenced by removal of the uterine appendages; these are material points of difference when compared with simple fibromyoma.

According to their locality, like simple fibromyoma, they may or may not be associated with uterine hæmorrhage; but, as they are most frequently interstitial or subserous, this symptom is seldom prominent.

The diagnosis is at all times difficult, and particularly so in the stalked subserous form where the signs may be identical with those of a cystic ovarian tumour. The symptoms, as we have seen, are by no means characteristic. Although special attention has been directed by Routh and Tait to the general absence of uterine hæmorrhage, this, however, is doubtless due to their rarity as submucous tumours.

When interstitial, their soft consistence and rapid growth, the usual absence of uterine hæmorrhage, and the associated enlargement of the uterine cavity, must at all times be considered suspicious; while if developed after the menopause, and causing painless enlargement of the uterus without hæmorrhage, the diagnosis is almost assured. In like manner, when a large, soft, regular uterine growth is found developing in a patient under thirty years of age, with or without hæmorrhage, the presence of a so-called "œdematous fibroid" is strongly probable.

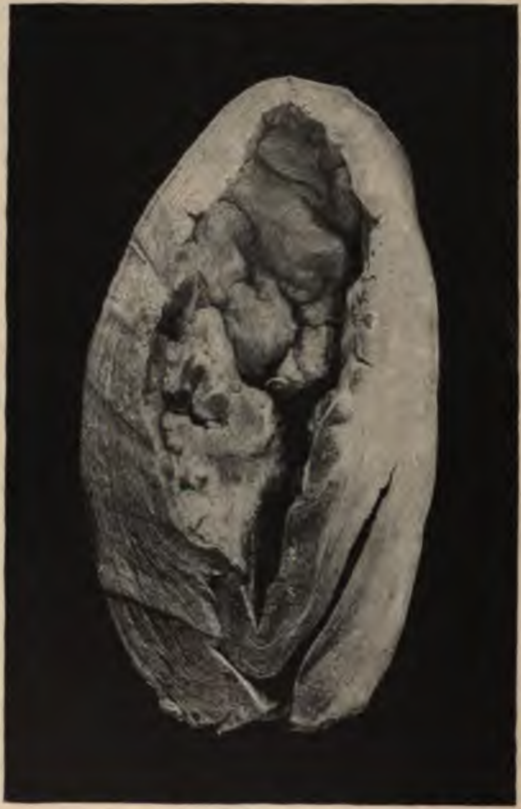

FIG. 99.—Unilocular fibrocyst from degenerated interstitial tumour of posterior uterine wall

Aspiration has been recommended in order to ascertain the special characteristics of the fluid as regards coagulability, and so forth. Such a procedure, however, cannot be too severely condemned: first, in the early stages no fluid can be withdrawn; secondly, so extremely feeble is their vitality that a fatal issue may be caused from resulting gangrene of the tumour; and, lastly, as removal is the only treatment, whether for this condition or for any tumour for which it can be mistaken, exploratory tapping must at best be unnecessary. It may further be stated that spontaneous coagulability, although it occurs in the majority of cases, is by no means a specific character. A uterine souffle is evident in all cases of the interstitial kind; but the one case of stalked subserous fibrocystic tumour I have seen could not be distinguished from an ovarian cystoma, for the souffle was entirely absent.

Another variety of cystic degeneration, the "cavernous angioma," though pathologically well known, is extremely rare in practice. It is characterised by the abnormal development and dilatation of the blood-vessels of the growth, a change which may affect the whole tumour, or be localised in patches. Virchow (69) first drew attention to its occurrence and named the condition "Myoma telangiectodes." On section the tumour appears as a spongy mass containing a large number of cavities, which vary in size from that of a pin-head to a pea, and contain soft reddish thrombi. Subsequently, from rupture of these small cysts, with resulting coalescence, larger cavities are formed with irregular walls which closely resemble the interior of the cardiac ventricles. Microscopically, the characteristic feature is the innumerable cavities filled with blood, the smaller ones being lined by endothelium; these are separated from each other by intervening fibrous and muscular tissue, in which run many capillaries. Examples have been recorded by Cruveilhier, Lee, Weber, Leopold, and others. In many instances they are clinically to be recognised by their increase at the menstrual periods, and their subsequent diminution.

Two examples of primary origin of these tumours in the uterus have been recorded by Klob (36) and Boldt.

Though but few angiomatous tumours have been met with and described, it is probable that this kind of secondary change may form the origin of fibrocystic myomas, as it is well known that angiomatous growths are particularly liable to undergo a secondary cystic transformation. Further, the appearances presented by cystic angioma in other situations closely simulate those met with in a number of fibrocystic growths of the uterus.

This variety of cystic change may also be associated with an apparently sarcomatous infiltration of the growth proper, an example of which is described by Aslanian.

A close connection exists between this variety of tumour and the ordinary infiltrative type of cystic degeneration; for though in the early stages they may appear widely dissimilar, in the later stages of large cyst formation and degeneration, their appearances must be almost identical; moreover, actual cases of combined lymphangiectoid and telangiectoid growths have been described by Müller.

It will thus be obvious how intricate is the pathology of fibrocystic uterine tumours, since tumours, which in their origin appear widely different, may subsequently assume identical features. It is probable that their rarity to a great extent accounts for the indefiniteness of our knowledge of their development.

Adenomyoma.—As the name implies, these tumours are due to the coincidence of glandular structure with fibromyoma. They are probably the result of infiltration of the fibromyoma by glands from the endometrium. Usually they are diffuse and not encapsuled, and they are most commonly situated at the tubal angles of the uterus. The condition is rare, and was first described by Cullen in association with adenocarcinoma. They have also been noted by Kelly, S. J. Cameron, and others (72), and are probably the origin of the rare carcinomatous changes in fibromyoma.

The Association of malignant uterine disease with fibromyoma.—Until recently not only was this coincidence considered rare, but it was thought that the mere presence of a fibromyoma prevented the development of cancer. Now, on the other hand, some observers, such as Richelot, assert that fibroids really predispose to malignancy. As is usual with such divergent views, mature deliberation tends to direct us midway between the two extremes; and from experience and investigation there seems to be little doubt that the two conditions of malignancy and fibromyoma have an almost entirely independent origin, and but slightly affect one another. The exception to this statement, *i.e.* where they may be said to depend on one another, is the malignant degeneration of the fibroid itself, which is an extremely rare occurrence.

The subject of malignancy and fibroids may be considered from the following standpoints:—

1st. Malignant degeneration of fibromyoma.

2nd. The coincidence of carcinoma or sarcoma of the uterine mucosa with fibromyoma.

3rd. Malignant changes in the cervix after supravaginal hysterectomy.

(1) *Malignant degeneration of fibromyoma.*—That fibromyoma may become secondarily malignant is generally admitted, though it is by no means so common as might be inferred. Authentic cases of sarcomatous change in a pre-existing fibroid are few, yet it is probable that all encapsulated sarcomas were originally fibromyomas. In the majority of cases the sarcomatous growth is of the small spindle-celled variety, and seems to arise from the connective-tissue stroma, although a small round-celled variety arising from the muscle fibres has been described. Statements vary exceedingly as regards the frequency of sarcomatous degeneration. Thus, von Franqué states it to occur in between 3 and 4 per cent of all cases, while Cullingworth met with only one case of myxosarcoma in 300 examples of fibroid, and Noble only two in 258 cases. Personally I have observed only one undoubted example out of over 400 cases; and on consulting the case-book statistics of Professor Simpson's ward in the Edinburgh Royal Infirmary, I find no instance occurred in the last 300 cases of fibromyoma. In taking these statistics *en masse*, in only four cases out of 1250 fibromyomas has sarcomatous change occurred. As a rule sarcomatous change occurs after or about the

enopause, and is perhaps the most common, but by no means the only ause of increase in size of a fibromyoma after the climacteric. From he rapid increase in size of the tumour severe pain is a constant ymptom. Thus, if after the menopause along with enlargement of a nown fibroid there is pain and loss of strength, the diagnosis of arcomatous change is almost certain.

Cystic and œdematous infiltration and degeneration of fibroids, with light cellular proliferation resembling myxosarcoma, I have observed on wo occasions. In one of these the intervening spaces were filled with lood-clot, which gave the appearance of the telangiectatic tumour escribed first by Cruveilhier. In these cases the cellular proliferation, hough assuming the embryonic type, is so scanty that one can hardly lassify them as sarcoma. After removal there has been no sign of ecurrence as was to be expected.

Malignant epithelial infiltration of fibromyoma is of extreme rarity, nly one or two cases having been cited. In these instances the original umour was probably an adenomyoma, a tumour due to infiltration of the muscularis of the uterus by glands from the endometrium.

(2) *Coincident malignant disease of the uterine mucosa with fibromyoma.*—It is probable that malignant disease of the corpus uteri is more prone to develop in uteri, the seat of fibromyoma. Out of nine cases of adenocarcinoma I have operated upon, three were associated with fibroids of sufficient size to be noticed by the patients themselves, while in a fourth case a small fibroid nodule was present in the uterine wall. That this should be so is to be expected from the necessarily increased vascularity of the organ as a whole, and of the endometrium in particular. In support of it is the frequency with which mucous polypi of the uterine body complicate fibroids. My own experience shows 13 cases out of 140 hysterectomies. This association of endometric growths with fibromyomas is of clinical importance in so far as they frequently give rise to severe hæmorrhage, in cases in which fibroids have been long known to be present, though quiescent. Where marked bleeding occurs with previously quiescent fibroids, the uterine cavity should in all cases be thoroughly explored by the finger and curetted at once, so as to determine if any endometric change is present, and if so, of what nature.

Malignant disease of the cervix, on the other hand, must be considered a rare complication of fibroids. In my personal experience I have only on one occasion met this coincidence when the fibroid was large enough or situated in such a position as to give rise to symptoms, although on three occasions I have noted small unimportant nodules in uteri removed for cervical cancer. The statistics of the Edinburgh Hospital which I have consulted agrees with this experience. The comparative rarity of malignant cervix with fibromyoma is partially to be explained by the frequent association of sterility due to the fibroid, and thus the absence of the essential predisposing factor to its development is removed, viz. laceration of the cervix. That sterility is

Fatty degeneration is of extreme rarity. Examples, however, are described by Turner and Hewitt (66); and a specimen, described by Sir James Paget, is to be found in St. Bartholomew's Museum (Series 33, No. 74).

Lardaceous degeneration is described in a unique case quoted by Stratz.

Colloid and Myxomatous changes, on the other hand, are comparatively frequent; but as they are intimately associated with the cystic changes later to be described, consideration of them may be deferred.

Malignant degeneration and infiltration of fibromyoma is entirely confined to the connective-tissue or sarcomatous type; it is probable, indeed, that all encapsulated sarcomas were originally fibromyomas. Carcinoma never occurs in fibroids.

Spontaneous sloughing, or "necrobiosis," as it is termed by some authors, has been met with, either partial or complete, and unassociated with septic influences or gangrene; it is due to a sudden and complete arrest of the circulation through the tumour, resulting from a twisted pedicle or sustained compression. When due to the former, it is associated with symptoms of pain, fever, and peritonitis, similar to those occurring with a twisted pedicle in ovarian tumours. True gangrene, however, is much more frequent. This is particularly apt to occur in submucous growths which, after the complete arrest of their circulation by uterine contraction or cervical constriction, become exposed to the influence of septic organisms entering by some ulceration or abrasion in the capsule. In this manner complete and rapid disorganisation of the tumour results; the growth may be slowly expelled. The expulsion is always associated with a vaginal discharge of an intensely fœtid character. In many instances the termination is favourable to the patient, although, of course, death may ensue from general septic infection. Artificial attempts to bring about this natural process of cure by destruction of the capsule have been made, although generally with most disastrous consequences. The term necrobiosis has been applied by Fairbairn and others to a degenerative change, associated with a dark purplish discoloration of the tumour, which is probably due to an interference with the venous return. This will be subsequently considered in connection with cystic changes.

Suppuration and abscess formation is the most frequent result of ulceration or destruction of the capsule, whether due to such interference as curettage, or the introduction of tents or other instruments for diagnostic purposes, or to natural causes. It may, however, occur rarely in subperitoneal and interstitial tumours, where no external interferences can be ascertained. Examples of such have been recorded by Lee, Lisfranc, and Jonas; and in a case of Bernays, treated by laparotomy, the enormous amount of six gallons of pus was evacuated from a subperitoneal growth. That true suppuration can occur without direct inoculation by organisms is perhaps contrary to the weight of present pathological teaching; it is important, therefore, carefully to examine the pus in those obscure cases, in order to ascertain the presence or absence of organisms. A number of cases have been recorded by Hal and others in which suppuration of fibroids occurred during the puerperium, a result, no doubt, of septic absorption from the placental site, or from bruises caused during labour.

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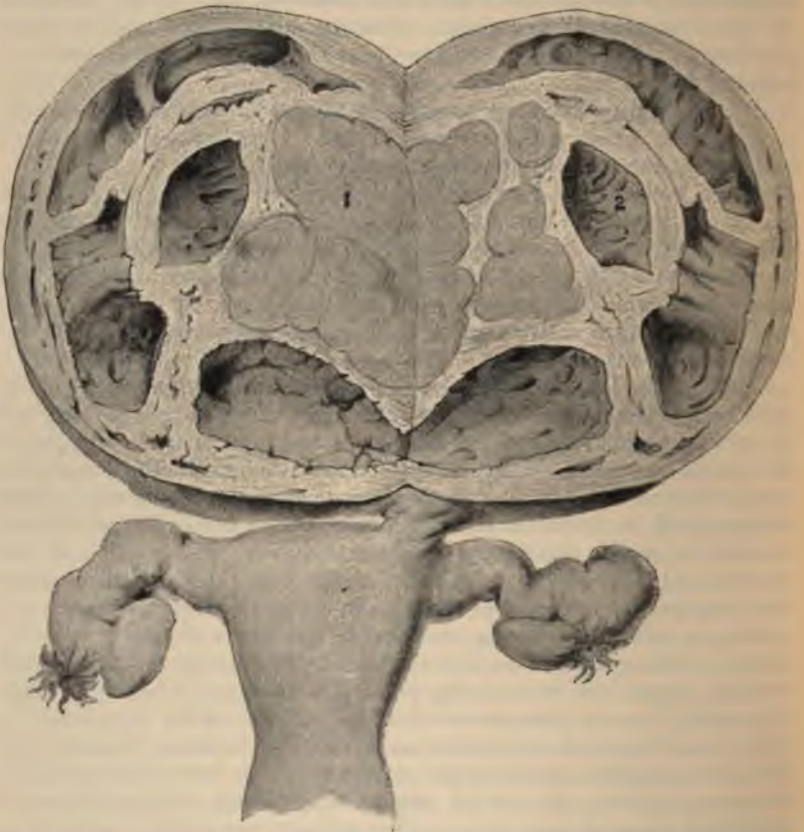

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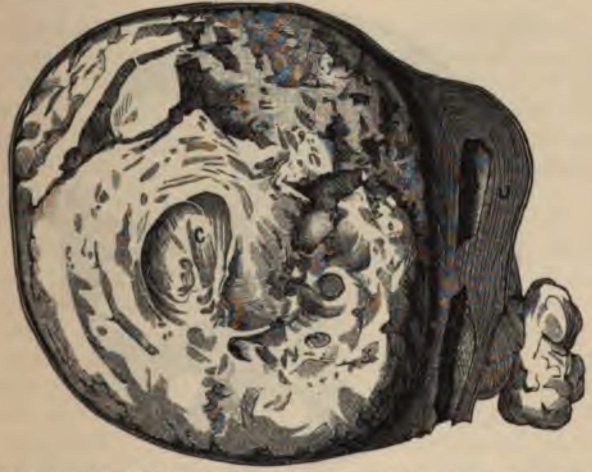

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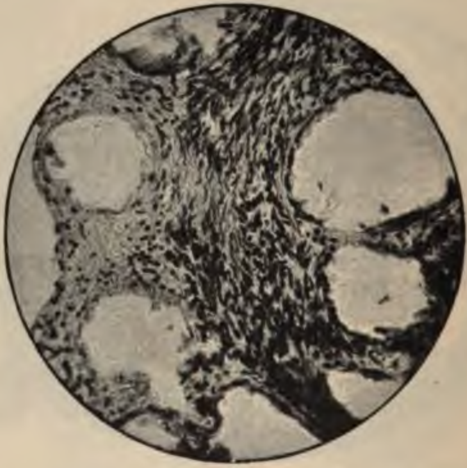

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Impairment of the circulation may also be met with in stalke subserous tumours as the result of obstruction to the circulation in th pedicle. This is beautifully demonstrated in the preparation from which Fig. 96 was drawn. In such cases large cysts may be rapidly formed and extensive hæmorrhages occur. In submucous polypi œdema is of course extremely common, but their expulsion is usually completed before large cysts are developed, or, sloughing and gangrene occur from subsequent complete arrest of the circulation.

From a clinical aspect fibrocystic tumours are extremely interesting. In the early stages they have a soft, boggy consistence which is apt to be mistaken for fluctuation. In the later stages, when large cavities are present, fluctuation may be made out; though from the thickness of their walls this is by no means definite, even when the cavities are of considerable size. The entire tumour may become disintegrated and form a unilocular cyst, as seen in Fig. 99, which I removed from a young woman of twenty-six.

Large cysts are specially likely to occur in pedunculated subserous growths; indeed, in fifty cases collected by Heer, five only were interstitial and two submucous. Coussat describes a fibrocyst of the cervix. Cullingworth (13) describes a similar condition in which the tumour weighed over 6 lbs., and developed rapidly after the menopause. On the other hand, in interstitial tumours simple œdematous change without the formation of large cavities vastly preponderates. As I have already pointed out, this change is almost always met with in solitary tumours; although in one case I observed small secondary nodules in the uterine wall. Their growth is more rapid than that of simple fibroids, but usually slower than that of a glandular ovarian cystoma; however, there are many exceptions to this rule. They may attain an enormous size; examples of 80 lbs. weight have been recorded. Again, they may rapidly assume large proportions from the occasional rupture of large vessels in their interior. In a case cited by Routh several such ruptures were said to have been distinctly felt by the patient. The sudden and definite enlargement from hæmorrhage, common in these tumours, may be also met with in ovarian cysts.

Cystic degeneration may occur at any age, and the subsequent growth of the tumour seems to be uninfluenced by the ovaries. Thus cystic and œdematous tumours may first give indications of their presence after the climacteric; moreover, they are in no way influenced by removal of the uterine appendages; these are material points of difference when compared with simple fibromyoma.

According to their locality, like simple fibromyoma, they may or may not be associated with uterine hæmorrhage; but, as they are most frequently interstitial or subserous, this symptom is seldom prominent.

The diagnosis is at all times difficult, and particularly so in the stalked subserous form where the signs may be identical with those of a cystic ovarian tumour. The symptoms, as we have seen, are by no means characteristic. Although special attention has been directed by Routh and Tait to the general absence of uterine hæmorrhage, this, however, is doubtless due to their rarity as submucous tumours.

When interstitial, their soft consistence and rapid growth, the usual absence of uterine hæmorrhage, and the associated enlargement of the uterine cavity, must at all times be considered suspicious; while if developed after the menopause, and causing painless enlargement of the uterus without hæmorrhage, the diagnosis is almost assured. In like manner, when a large, soft, regular uterine growth is found developing in a patient under thirty years of age, with or without hæmorrhage, the presence of a so-called "œdematous fibroid" is strongly probable.

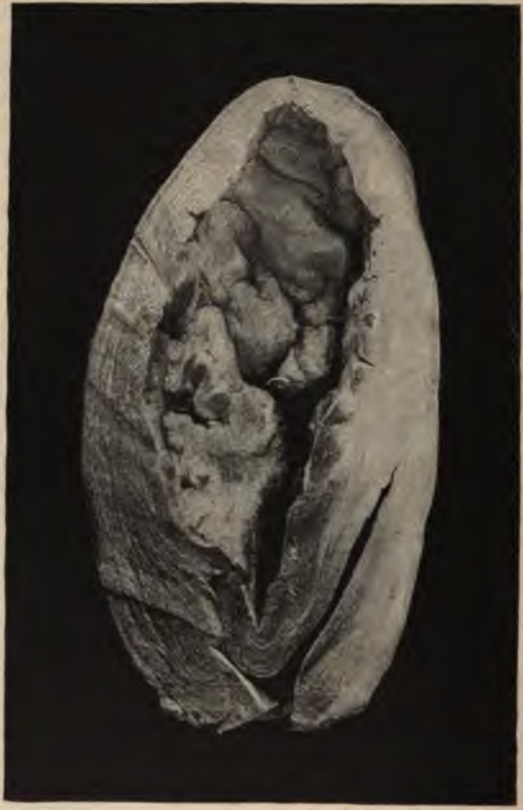

FIG. 99.—Unilocular fibrocyst from degenerated interstitial tumour of posterior uterine wall

Aspiration has been recommended in order to ascertain the special characteristics of the fluid as regards coagulability, and so forth. Such a procedure, however, cannot be too severely condemned: first, in the early stages no fluid can be withdrawn; secondly, so extremely feeble is their vitality that a fatal issue may be caused from resulting gangrene of the tumour; and, lastly, as removal is the only treatment, whether for this condition or for any tumour for which it can be mistaken, exploratory tapping must at best be unnecessary. It may further be stated that spontaneous coagulability, although it occurs in the majority of cases, is by no means a specific character. A uterine souffle is evident in all cases of the interstitial kind; but the one case of stalked subserous fibrocystic tumour I have seen could not be distinguished from an ovarian cystoma, for the souffle was entirely absent.

Another variety of cystic degeneration, the "cavernous angioma," though pathologically well known, is extremely rare in practice. It is characterised by the abnormal development and dilatation of the blood-vessels of the growth, a change which may affect the whole tumour, or be localised in patches. Virchow (69) first drew attention to its occurrence and named the condition "Myoma telangiectodes." On section the tumour appears as a spongy mass containing a large number of cavities, which vary in size from that of a pin-head to a pea, and contain soft reddish thrombi. Subsequently, from rupture of these small cysts, with resulting coalescence, larger cavities are formed with irregular walls which closely resemble the interior of the cardiac ventricles. Microscopically, the characteristic feature is the innumerable cavities filled with blood, the smaller ones being lined by endothelium; these are separated from each other by intervening fibrous and muscular tissue, in which run many capillaries. Examples have been recorded by Cruveilhier, Lee, Weber, Leopold, and others. In many instances they are clinically to be recognised by their increase at the menstrual periods, and their subsequent diminution.

Two examples of primary origin of these tumours in the uterus have been recorded by Klob (36) and Boldt.

Though but few angiomatous tumours have been met with and described, it is probable that this kind of secondary change may form the origin of fibrocystic myomas, as it is well known that angiomatous growths are particularly liable to undergo a secondary cystic transformation. Further, the appearances presented by cystic angioma in other situations closely simulate those met with in a number of fibrocystic growths of the uterus.

This variety of cystic change may also be associated with an apparently sarcomatous infiltration of the growth proper, an example of which is described by Aslanian.

A close connection exists between this variety of tumour and the ordinary infiltrative type of cystic degeneration; for though in the early stages they may appear widely dissimilar, in the later stages of large cyst formation and degeneration, their appearances must be almost identical; moreover, actual cases of combined lymphangiectoid and telangiectoid growths have been described by Müller.

It will thus be obvious how intricate is the pathology of fibrocystic uterine tumours, since tumours, which in their origin appear widely different, may subsequently assume identical features. It is probable that their rarity to a great extent accounts for the indefiniteness of our knowledge of their development.

Adenomyoma.—As the name implies, these tumours are due to the coincidence of glandular structure with fibromyoma. They are probably the result of infiltration of the fibromyoma by glands from the endometrium. Usually they are diffuse and not encapsuled, and they are most commonly situated at the tubal angles of the uterus. The condition is rare, and was first described by Cullen in association with adenocarcinoma. They have also been noted by Kelly, S. J. Cameron, and others (72), and are probably the origin of the rare carcinomatous changes in fibromyoma.

The Association of malignant uterine disease with fibromyoma.—Until recently not only was this coincidence considered rare, but it was thought that the mere presence of a fibromyoma prevented the development of cancer. Now, on the other hand, some observers, such as Richelot, assert that fibroids really predispose to malignancy. As is usual with such divergent views, mature deliberation tends to direct us midway between the two extremes; and from experience and investigation there seems to be little doubt that the two conditions of malignancy and fibromyoma have an almost entirely independent origin, and but slightly affect one another. The exception to this statement, *i.e.* where they may be said to depend on one another, is the malignant degeneration of the fibroid itself, which is an extremely rare occurrence.

The subject of malignancy and fibroids may be considered from the following standpoints:—

1st. Malignant degeneration of fibromyoma.

2nd. The coincidence of carcinoma or sarcoma of the uterine mucosa with fibromyoma.

3rd. Malignant changes in the cervix after supravaginal hysterectomy.

(1) *Malignant degeneration of fibromyoma.*—That fibromyoma may become secondarily malignant is generally admitted, though it is by no means so common as might be inferred. Authentic cases of sarcomatous change in a pre-existing fibroid are few, yet it is probable that all encapsulated sarcomas were originally fibromyomas. In the majority of cases the sarcomatous growth is of the small spindle-celled variety, and seems to arise from the connective-tissue stroma, although a small round-celled variety arising from the muscle fibres has been described. Statements vary exceedingly as regards the frequency of sarcomatous degeneration. Thus, von Franqué states it to occur in between 3 and 4 per cent of all cases, while Cullingworth met with only one case of myxosarcoma in 300 examples of fibroid, and Noble only two in 258 cases. Personally I have observed only one undoubted example out of over 400 cases; and on consulting the case-book statistics of Professor Simpson's ward in the Edinburgh Royal Infirmary, I find no instance occurred in the last 300 cases of fibromyoma. In taking these statistics *en masse*, in only four cases out of 1250 fibromyomas has sarcomatous change occurred. As a rule sarcomatous change occurs after or about the

enopause, and is perhaps the most common, but by no means the only ause of increase in size of a fibromyoma after the climacteric. From e rapid increase in size of the tumour severe pain is a constant mptom. Thus, if after the menopause along with enlargement of a iown fibroid there is pain and loss of strength, the diagnosis of rcomatous change is almost certain.

Cystic and œdematous infiltration and degeneration of fibroids, with ght cellular proliferation resembling myxosarcoma, I have observed on o occasions. In one of these the intervening spaces were filled with ood-clot, which gave the appearance of the telangiectatic tumour scribed first by Cruveilhier. In these cases the cellular proliferation, ough assuming the embryonic type, is so scanty that one can hardly assify them as sarcoma. After removal there has been no sign of currence as was to be expected.

Malignant epithelial infiltration of fibromyoma is of extreme rarity, ily one or two cases having been cited. In these instances the original imour was probably an adenomyoma, a tumour due to infiltration of the iuscularis of the uterus by glands from the endometrium.

(2) *Coincident malignant disease of the uterine mucosa with fibromyoma.*—t is probable that malignant disease of the corpus uteri is more prone develop in uteri, the seat of fibromyoma. Out of nine cases of denocarcinoma I have operated upon, three were associated with fibroids f sufficient size to be noticed by the patients themselves, while in a urth case a small fibroid nodule was present in the uterine wall. That is should be so is to be expected from the necessarily increased scularity of the organ as a whole, and of the endometrium in particular. support of it is the frequency with which mucous polypi of the erine body complicate fibroids. My own experience shows 13 cases t of 140 hysterectomies. This association of endometric growths ith fibromyomas is of clinical importance in so far as they frequently ve rise to severe hæmorrhage, in cases in which fibroids have been ng known to be present, though quiescent. Where marked bleeding curs with previously quiescent fibroids, the uterine cavity should in l cases be thoroughly explored by the finger and curetted at once, as to determine if any endometric change is present, and if so, of hat nature.

Malignant disease of the cervix, on the other hand, must be condered a rare complication of fibroids. In my personal experience I ave only on one occasion met this coincidence when the fibroid was large iough or situated in such a position as to give rise to symptoms, lthough on three occasions I have noted small unimportant nodules in teri removed for cervical cancer. The statistics of the Edinburgh ospital which I have consulted agrees with this experience. The omparative rarity of malignant cervix with fibromyoma is partially be explained by the frequent association of sterility due to the ibroid, and thus the absence of the essential predisposing factor to its levelopment is removed, viz. laceration of the cervix. That sterility is favoured by fibroids is denied by some authors, but personal experience leads me to believe it is one of the most striking clinical features connected with these growths. It is probable, therefore, that fibromyomas themselves in no way influence the development of cervical cancer, and the association is only to be considered a coincidence.

(3) *Malignant degeneration of the cervical stump after subtotal hysterectomy.*—This is considered by Richelot of sufficiently frequent occurrence to warrant panhysterectomy being performed in all cases. Curiously enough he has in his own experience had three cases out of a total of thirteen recorded. This is, however, contrary to the experience of the majority of other operators who, from the rarity of this complication, the rapidity of the subtotal operation, and the smaller mortality incurred, strongly favour this method. My own experience is thoroughly in accord with these advantages of this method. In over 100 cases I have thus operated on, I have seen no malignant degeneration of the stump.

It seems probable that in two of Richelot's cases cancer was present before operation, otherwise it is difficult to account for this extraordinary percentage of malignancy. In this connection Bland-Sutton records an interesting case where cancer was present, though unsuspected, in the cervix, and reappeared in the vaginal cicatrix after panhysterectomy.

Diffuse nodular fibrosis.—I have used this term for the description of an example of an unique variety of degeneration which I removed from a woman of thirty-eight who had suffered from severe bleeding for twelve years (Fig. 100). The uterus was enlarged to the size of that of a six months' pregnancy. It retained its normal shape, and the entire wall was uniformly thickened by the presence of innumerable nodules of varying sizes which were unencapsulated by muscular tissue as in ordinary multiple fibromyoma. Many of the nodules projected into the uterine cavity, and some formed polypoidal growths. A thickish layer of muscle enclosed the nodular structure, and gave the uterus, from its external aspect, a uniform smooth appearance, with the exception of one small nodule on the left side.

Pregnancy and Fibromyoma.—As already stated, there can be little doubt that uterine fibroids as a class tend materially to prevent pregnancy, and are a direct cause of sterility both relative and absolute; equally certain is it that their presence in the uterine wall prevents this function to an increasing extent as the tumour approaches the uterine mucosa. For this reason the submucous type is most closely identified with sterility, as then the extreme vascularity of the mucosa makes it an unfavourable seat of implantation for the impregnated ovum, and one from which it is apt to become separated by hæmorrhage. Sterility is less likely to occur with small subserous and interstitial tumours, though distinctly to be traced in some cases; in many cases it is due to the habitual occurrence of abortion, which is probably induced in part by the difficulty of uterine dilatation, in part by the tendency to hæmorrhage from increased vascularity.

In a case of large interstitial fibroid of the anterior uterine wall, ich came under my own observation, the dilatation of the uterus was interfered with, that the cavity was distended in the form of an ur-glass; the placenta was situated in the upper compartment, and fœtus grew (till the 18th week) in the lower. After abortion it s found impossible to remove the placenta, as the communication tween the two cavities was not large enough to admit the finger; th occurred from septicæmia. The uterus and tumour weighed 9 A similar case is described by Lusk.

Should gestation proceed to full term, parturition may or may not be erfered with. The effect naturally varies with the position of the

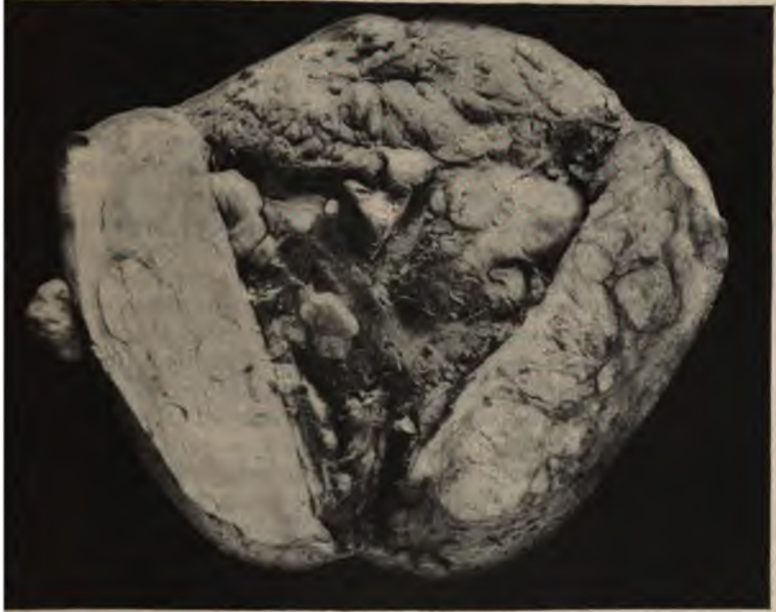

FIG. 100.—Diffuse nodular fibrosis, showing numerous polypoidal growths in uterine cavity, and nodular fibrous character of thickened uterine wall.

wth: when low in the uterus, or subserous and incarcerated in the vis, it may form an insuperable barrier to the birth of the child; when her in the uterine wall it frequently causes uterine atony and gular contractions, with their accompaniments of delay and hæmorrhage. mucous pedunculated tumours frequently present in front of the child.

From the unequal dilatation of the uterine cavity malpresentations he fœtus are common. Lefour found that of 100 pregnancies thus plicated 49 per cent were preternatural in their presentation. nckel estimates breech presentations to be eight times more common, transverse to be increased thirty-five-fold. Moreover, there is a ided tendency to prolapse of the cord; and undoubtedly placenta via is more frequently met with.

Although pregnancy and parturition are frequently in no way affected by the presence of fibroids, it must be acknowledged that in proportion to the size and position of the growth their association increases the risks both to mother and child. Susserot, in 147 cases of pregnancy, shows a mortality of 55 per cent, while Pozzi asserts that in interstitial fibroids of large size the mortality is as high as 53 per cent. Although such statistics by no means represent the general mortality from pregnancy associated with fibroids, they are of value in demonstrating the possible gravity of their presence.[1]

Of great interest also is the effect of pregnancy on the fibroids themselves. With its occurrence the tumour in most instances rapidly increases in size, the enlargement being due to hypertrophy of the individual muscular fibres of the tumour, and to a serous infiltration of the intercellular tissue from increased vascularity. The consistence of the growth is thus much changed, and from its softness its true nature may be mistaken. After parturition an involution of the muscular elements occurs simultaneously in the tumour and in the uterus itself; and this may be so marked that positive diminution or even total disappearance of the tumour may occur. This happy result is probably attained by firm uterine contraction impairing the blood-supply to the growth, and causing a degeneration of the muscle fibres analogous to that which occurs in normal puerperal involution. Such a favourable termination is unfortunately by no means the rule; indeed, from my own observations, a permanent enlargement of the tumour is the more common consequence. In some cases this is more evident than in others, and is due to the extrusion of the growth from the uterine wall, by contraction of the organ; but in many instances I have carefully noted a permanent increase after pregnancy, a result which probably accounts for the frequency of subsequent sterility in these cases. Puerperal uterine contractions often cause expulsion of submucous growths; this I have seen twice within two months of the confinement, the expulsion in each case being associated with alarming hæmorrhage. Submucous tumours are also liable, from the contraction of the uterus cutting off their blood-supply, to become gangrenous, and hence to be a source of septic infection. This result may also occur in subserous tumours. From the serous infiltration present during pregnancy the tumour may continue to grow rapidly after delivery, from increased connective tissue proliferation and other secondary changes.

True suppuration may be met with in subserous tumours as a result of parturition; this has been shown by Spiegelberg to be due to the passage of organisms from the uterus through the lymph spaces. These tumours may also slough from bruising during labour, and may thus give rise to fatal peritonitis.

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[1] More recent statistics than those quoted above show very different results. Thus in 1902 Méheut reported 85 cases from the Clinique Baudelocque (Paris) with but five deaths, and only two of these could be attributed to the fibroid tumour (*Rev. prat. d'Obstét. et de Gynécol.* 1902).—Ed.

Gangrene and sloughing of a submucous polypus are described by Charrier to have occurred during pregnancy; the patient recovered, though birth of the fœtus took place before the removal of the septic mass.

Submucous polypi have frequently been described as presenting in front of the fœtus during labour, and in several instances have been mistaken for the fœtal head and delivered by forceps (21).

The diagnosis of pregnancy with fibromyoma is usually simple, though at times great difficulty may be experienced.

Amenorrhœa coincident with a rapid enlargement of the uterus and attached tumour, is at all times suspicious and almost characteristic. Occasionally, however, menstruation may continue for some months in spite of gestation, and here by palpation alone can the true condition be ascertained.

Large interstitial tumours when associated with pregnancy may, from the regular contour of the rapidly enlarging tumour, closely simulate a hydatidiform degeneration of the chorion (9) or a rapidly growing cystic myxosarcoma. In like manner an intraligamentary growth may resemble an extra-uterine gestation so closely, that absolute certainty of diagnosis is impossible. Simpson describes such a case (58). If, however, in these cases the uterus itself be definable from the intra-ligamentary growth, its size will be of great value in distinguishing it from an extra-uterine gestation; as in the latter the uterus, though enlarged, never corresponds with the size of a normal intra-uterine pregnancy.

As the tumour may mask the signs of pregnancy, it is well in all cases of rapidly growing fibroids to remember the possibility of the concurrence, for by this caution many serious and even fatal errors may be avoided.

The treatment to be adopted where pregnancy is complicated by fibromyoma must vary according to the existing conditions in each individual case. Unless urgent symptoms demand active measures interference is uncalled for.

When the growths are small pregnancy is but seldom affected by their presence; and even large tumours may but slightly interfere with its normal completion. The methods by which nature may overcome difficulties apparently insuperable are certainly surprising. Many cases are on record of primarily incarcerated growths which have grown upwards into the abdomen after gestation was far advanced; indeed, this may take place as the result of retraction even during labour. When from pressure or other causes interference is demanded, the position and character of the growth must necessarily decide the method of treatment. When low in the uterus and remaining pelvic, it may give rise to symptoms of gravid retroversion; or, as in a case of my own, such symptoms may be induced by a large tumour of the anterior wall causing the gravid uterus itself to be retroposed and incarcerated. In these cases, even if pressure symptoms be absent, which they seldom are, attempts at reposition are demanded, as the tumour must form an unsurmountable barrier to delivery.

If no symptoms of pressure be present, though incarceration exist in spite of attempts at reposition, it is well to allow pregnancy to proceed without interference; for the tumour in the later months, or even during labour, may be drawn out of the pelvis and in no way interfere with delivery. Should it still, however, remain fixed, and thus entirely block the passage of the child, laparotomy is the only resource. The choice of operation to be adopted must vary with the situation; but complete hysterectomy would certainly appear to be preferable to either simple Cæsarean section or Porro's operation. The mortality from Cæsarean section is stated by Sänger to be 83·7 per cent. The induction of abortion when the tumour is placed low in the uterus is rendered difficult and dangerous by want of dilatability of the lower uterine segment and cervix, which may render it impossible to introduce the finger for removal of the secundines. Should the tumour be intravaginal its removal can at any time be performed without inducing labour.

Large abdominal fibroids with pregnancy, which give rise to urgent symptoms, may be treated either by induction of labour or abdominal section. The former operation, on account of its minor severity, has been strongly advocated by a large number of writers, but has been equally strongly condemned by others, who base their arguments partly on the high mortality after even spontaneous abortion—which has been stated by Lefour to be about 35 per cent—and partly on the fact that the growth remains untreated.

The treatment by laparotomy at the hands of Schroeder (56) and others has been doubtless most satisfactory.

The details of the operation necessarily vary with the position and size of the tumour. If pedunculated, the tumour may be removed by myomectomy, and the pregnancy continue; a successful result is thus frequently obtained. If sessile or interstitial, the site or size of the growth must govern the method of operation, yet even in these cases myomectomy has been performed without interfering with the progress of gestation, as shown by Leopold (41). He further states that in thirty-one cases of myomectomy during pregnancy for pedunculated or sessile tumours seven mothers died, and seventeen carried to full time, twenty-one were operated on between the fourth and six months.

The Porro-Cæsarean operation, or the entire removal of the uterus, are the methods chiefly followed. A successful case of the latter has been described by Jessett. Ordinary Cæsarean section, on account of its excessive mortality already cited, should not be performed, even in the few cases which may seem suitable for its adoption.

In general, therefore, the magnitude of these operations and their far from uniform success would incline us to the less heroic measure of the induction of abortion, if urgent symptoms should arise from large abdominal fibroids complicating pregnancy. But each case must be treated on its own merits, the urgency of the symptoms in some cases absolutely demanding immediate surgical interference.

TREATMENT OF FIBROMYOMA may be divided into Medical, Electrical, nd Surgical.

The **medical treatment** is chiefly symptomatic, although the entire disappearance of growths has been attributed in some instances to its means. Many drugs have been recommended—such as mercury, iodides, and liq. calcis chloridi—which have been supposed to exert a direct absorptive effect on the tumour, and probably not without some reason. Sodium chloride mineral waters have an undoubted effect in this direction. Since the rapid advancement of gynæcological surgery, however, such uncertain methods have practically ceased to command attention, and treatment by drugs is now almost entirely confined to purely symptomatic uses.

As in the majority of cases hæmorrhage is the urgent symptom, and as it is one which more readily lends itself to medicinal remedies, it is needless to say that the drugs used to control it are many. Sulphuric and gallic acids, turpentine, cannabis indica, and many others, have had their day; but there are none which have in any way approached the value of ergot of rye, which, so far as present medical treatment is concerned, holds the field. Many writers strongly urge that by its use the development of the tumour is prevented, and its size reduced. There can be but little doubt that such a result is occasionally met with; although usually not until after many months or even years of active and regular employment. The action of ergot appears to be twofold: first, by causing contractions of the uterus, it tends to expel the tumour from its wall, and at the same time retards its circulation by direct pressure; secondly, by its well-known direct contractile action on the blood-vessels, it materially interferes with the nutrition of the growth. Though ergot seems but seldom to exert a curative effect upon the growth and development of the tumour, it is of great value in reducing the large amount of hæmorrhage associated with many of them, and as a uterine hæmostatic it has had, and still occupies a high position; though the more decided results derived from the scientific use of the galvanic current are now rapidly superseding this form of treatment. As directed by Hildebrandt, who first introduced it, ergot is best employed by hypodermic injection; and for this purpose the solution recommended by Prof. A. R. Simpson is very suitable, namely, ℞ Ergotine ʒij., Chloral hyd. ʒiv., Aq. dist. ʒvj. Twelve drops of the above contain 3 grs. of ergotine, which is an ordinary dose. The chloral is merely added as a preservative. Care must be taken to inject the solution deeply into some fleshy part, such as the buttock, so as to avoid abscess formation. The injections are to be made twice weekly as a rule, but every second day during the menstrual period; in this manner its use must be continued for months if any change in the growth is to be anticipated. The patient may be taught to inject it herself. The drug may be given by the mouth, or by suppository; but it seems thus to have a less decided effect.

Of late the fluid extract of hydrastis canadensis, in 20 to 30 minim doses, has been employed as a uterine hæmostatic in bleeding fibroids, and its use has met with much favour. From the difficulty in procuring the drug in a fresh state, however, treatment by this means has been too limited for us to formulate.

Electrical treatment.—The current administered is said to act—first, as a hæmostatic; secondly, by arresting the growth of the tumour; and, thirdly, in many instances by causing permanent diminution in the size of the growth. With ordinary care the treatment can be carried out without risk and with little inconvenience. The mode of application and indication are described in the article on "Minor Uterine Operations."

Surgical treatment.—Its aim may be either symptomatic or radical, its route vaginal or abdominal.

The symptomatic vaginal methods of treatment are naturally directed against the two urgent conditions of pressure and hæmorrhage.

Treatment of pressure symptoms.—The feeling of down-bearing, and the accompanying vesical symptoms, so frequently complained of as due to the simple increased weight of the uterus, may be much benefited by the introduction of an accurately fitting ring pessary. The extremely distressing pressure symptoms of fibroids located in the true pelvis may, if the growth be subserous and incarcerated, be generally removed by elevating the tumour above the brim of the pelvis and maintaining it in this position by a simple Hodge or ring pessary. This is, of course, applicable only to freely movable growths, such as pedunculated subserous tumours in the fundus of a retroverted or flexed uterus. When arising from the supravaginal cervix or lower part of the uterine body, such manipulation is impossible, the tumour being absolutely fixed in the pelvis.

The elevation of the tumour is most easily performed with the patient in the Sims or genu-pectoral position; steady upward pressure by the fingers is to be made through the vagina, or rectum, in a manner similar to that recommended for the reposition of a gravid retroflexion of the uterus. Should any difficulty be met with, the patient should be anæsthetised; as thus, by the relaxation of parts, resistance is frequently diminished in a surprising manner.

Treatment of hæmorrhage.—The mechanical methods for the arrest of hæmorrhage are manifold, and perhaps the most simple is intra-uterine injection or swabbing. The substances which have been used for this purpose include almost all known styptics; but that which seems to have given the most satisfactory results is undoubtedly iodine. Savage was the first to recommend this drug, and he preferred the injection of 1 or 2 drachms of the strong undiluted Edinburgh tincture. He was careful, however, to observe that, before injection, dilatation of the uterus must be obtained, which, by allowing of the free egress of the injected fluid, prevents the intense pain and occasional subsequent attacks of peritonitis previously met with after this method of treatment. Swabbing the interior of the uterus with a dressed uterine sound, previously dipped in the tincture of iodine, is to be preferred to the intra-uterine injections; it is more easily performed, and is equally efficacious.

In preference to the strong tincture, I have used with almost unfailing success a weak solution of the same tincture (ʒij. to ℥xvj. of water), and, with a Fritsch or Bozeman's catheter introduced to the fundus uteri, allowed the whole quantity slowly to pass through the uterus. This should be performed about the second or third day of the period, and so far experience has shown that it can be thoroughly relied upon. Previous dilatation is seldom necessary to allow of the introduction of the catheter, as during the menstrual period marked softening of the cervix and even dilatation of the os are usually met with.

Intra-uterine douching with hot water is a most valuable method of rapidly arresting uterine hæmorrhage. The water should be used at a heat exceeding 110° F., as below this temperature it only aggravates the condition. Simple vaginal syringing with water at the same temperature frequently has an immediate hæmostatic effect, by causing strong uterine contraction; but this cannot be depended upon. This action of hot water has been shown by the late Dr. Milne Murray to be due to the contractile effect upon unstriped muscle; thus the uterus itself, and the walls of the blood-vessels, are thrown into a prolonged tonic spasm without subsequent reaction.

Plugging.—This may be either vaginal or uterine, and is demanded when the hæmorrhage is so severe as to threaten life. Intra-uterine plugging by means of tupelo tents is the best method, as not only is direct pressure thus frequently brought to bear on the actual bleeding surface, but the resulting dilatation may assist in a marked degree in arresting subsequent bleeding; after removal of the tents, also, direct intra-uterine exploration can be made, and any subsequent operation performed which may seem advisable. Emmet recommends plugging the uterus with a tampon of cotton soaked in a solution of alum; this he introduces into the uterus in the form of a strip, an end being left hanging from the cervix for subsequent removal, should the uterus fail to expel it by induced contraction (19).

Incision of the capsule of the tumour, although followed immediately by a temporary excess of bleeding, subsequently diminishes the hæmorrhage to a great extent. This action is probably due to the relief of tension in the capsule, which permits of the retraction of the lacerated sinuses from which the bleeding arises, and at the same time mitigates the congestion which is present. Not only has incision a hæmostatic effect, but it has been recommended as a curative method, in order that, as the circulation of the tumour is impaired by the destruction of the capsule, the growth may undergo retrograde changes, and slough; as in some cases of polypus in which, from pressure or other causes, the nutrition is likewise interfered with. This method of treatment cannot, however, be too strongly condemned, as fatal results commonly occur, in consequence of the absorption of septic organisms from the gangrenous tumour.

Curettage of the uterine cavity is a procedure much practised by many gynæcologists. In cases of the small interstitial growths, which do not change the regular shape of the uterine canal, the operation may be practised with much temporary benefit as regards the menorrhagia; but in the vast majority of cases, which are projecting submucous growths, the use of the curette is of but little value, as it is impossible to remove the entire mucosa, and specially that portion of it which actually covers the growth, and which is the most fertile source of the hæmorrhage. At the same time the operation is by no means devoid of risk; as occasionally, from severe laceration and destruction of the capsule, subsequent death and gangrene of the tumour follow. In one case I have seen fatal consequences from this method of treatment, due to septicæmia from gangrene of the tumour.

Removal of the uterine appendages.—As a curative method of treatment for the bleeding from uterine myoma, this operation was first performed by Lawson Tait in 1872; since that time increased experience has proved it to be a great advance in gynæcological surgery. About the same time Battey of Georgia performed the operation of removal of the ovaries for dysmenorrhœa; but to Tait must the credit be given of associating the operation with the cure of fibroid tumours. The operation also differs materially in that Tait, while removing the ovaries, at the same time removed as much as possible of the Fallopian tube; by this means, he averred, the beneficial effect of the operation is much increased, by means of the consequent destruction of the nervous supply to the endometrium, which is chiefly centred in a large nerve trunk which enters the uterus just underneath the angle of attachment of the Fallopian tube.

The statistics of Tait show that of the first 272 cases in which he had operated in this manner for uterine fibromyoma, twelve succumbed from the operation; a mortality of 4·4 per cent. He further records, that of fifty cases followed for six years after the operation, in seventeen the tumour had entirely disappeared, and in fourteen had become so diminished as to be harmless: forty-one of the fifty were in perfect health.

Cases of failure are to be accounted for in two ways: first, inability or neglect to remove the entire ovary with its surrounding nerves; and secondly, the nature of the growth. From the size of the tumour, o from the direction of its growth, the layers of the broad ligament ma become so split that removal of the entire appendages is impossible; th operation is then valueless, both as regards the arrest of hæmorrhage an increase in size; to this, probably, the majority of failures in arrestin menorrhagia is to be credited.

It would appear that in the majority of cases the growth of œdemato tumours is not arrested. Unfortunately, though the mortality from th operation has been still further reduced, the uncertainty of absolute cu (10 per cent) must detract from the value of this method of treatmen and now that hysterectomy can be performed with greater certainty cure, the field for this operation has been materially narrowed. At the time of its adoption by Tait, when hysterectomy was associated with such an enormous mortality, it was undoubtedly the operation of choice.

and still remains as an excellent method of treatment under special circumstances.

The wholesale removal of uterine appendages for fibroids, without any previous attempts at treatment, cannot in the majority of cases be too strongly condemned, and must be considered not only unscientific, but culpable. Removal of the appendages should never be undertaken for small fibroids without previous dilatation and exploration of the uterine cavity, as small submucous polypi may be the sole cause of a bleeding which may be readily cured by their removal.

Operations for removal of the tumour.—These will be discussed in the articles "Minor Uterine Operations" and "Hysterectomy" (pp. 784 and 895).

B. Tumours of the Mucous Lining

The simple mucous growths of the uterus, from their tendency to become stalked and to protrude through the os externum into the vagina, are generally known as "mucous polypi"; but under this name are included new growths of widely different character. The name is also unhappy in so far as it is taken to represent the structure rather than the situation of the neoplasm. Growing, as these polypi do, from the mucosa, they are the result of a proliferation of the glandular or connective tissue elements alone or combined; and include therefore adenomas, fibro-adenomas, and fibromas.

The **simple adenoma** is usually met with in the cervix, and appears as a red, soft, smooth growth, varying in size from a pea to a walnut. On section it shows a sponge-like structure, due to the dilated glands which are separated from one another by thin trabeculæ of connective tissue. The gland cavities, visible to the naked eye, are filled with mucus; and, microscopically, they are seen to be lined with epithelium, varying from cubical to elongated cylindrical forms. The tumour is covered by epithelium which may be either cubical or stratified squamous. The latter form I have found covering polypi which sprang from at least a quarter of an inch within the canal of the cervix, and protruded into the vagina (30). The same thing has also been demonstrated by Underhill and Ackermann. In its simplest variety, which Semon has described as a papillary outgrowth from the vaginal aspect of the cervix, this form of epithelial covering is naturally more frequently met with.

In its most simple form this variety of growth is represented by a simple mucous gland which, on closure, has become distended with mucus (Nabothian follicle); and subsequently so protruded from the surface that it has become pedunculated. By the combination of a series of such cysts, with proliferation of the glandular mucosa, the more complex sponge-like growth is formed.

Usually, with the glandular proliferation, there is a corresponding development of interglandular connective tissue; this is generally of an extremely cellular character, and wanting in the fibrous elements. The growth in this instance has a somewhat firmer consistence, and is usually rough on its surface, so that it resembles a ripe strawberry. These growths may be sessile, forming protuberances within a dilated cervix; and it is probable that in many cases they owe their origin to cystic extension of the new glands in the so-called "erosion" of the cervix, so frequently met with in cervical inflammation.

In the same manner an inward growth of the new glandular structure into the cervical tissues with subsequent distension of the glands may arise, which is well known as "follicular hypertrophy of the cervix."

Localised glandular proliferation of the mucosa in the body of the uterus, comparable to that described in the cervix, and giving rise to distinct polypoidal intra-uterine growths, has been described by Gusserow (27), Schroeder (57), Duncan (18), and others, and has been designated "adenoma polyposa." It must, however, be considered as of rare occurrence.

A more common variety of intra-uterine growth is the **fibro-adenoma**, which may be looked upon, primarily, as a local hypertrophy of the normal mucous membrane. Usually in these cases the fibrous tissue predominates, the glands tending to increase rather in size than in number, and thus to form canals which permeate the growth in all directions; this variety of growth, as described by Underhill and others, has been called "channelled polypus." In some instances these growths are also found growing from the cervix. They may attain a large size; in one example described by myself the growth weighed 21 ounces. When small and multiple, the same condition has unfortunately been described, by Olshausen, under the name of "endometritis fungosa polyposa"—a name at once misleading and scientifically incorrect.

These neoplasms would appear from their structure to owe their origin to an active hypertrophy of the fibrous tissue of a portion of the mucosa. The glands situated in this area, however, do not themselves actually proliferate, but become enormously elongated from the outward growth of their surrounding fibrous stroma. The seat of active growth is seen by the microscope to be in the periphery of the tumour immediately beneath the epithelium. There the tissue is embryonic and cellular, while towards the centre it is fibrous and well formed.

By dilatation of the glands and obstruction to the escape of their secretion cysts may be formed. In these instances the growth corresponds exactly with the common fibrocystic tumours of the mamma which, among many other names, have been called "fibrome intracanulaire" and "cystosarcoma fibrosum." Like the mammary tumours they are essentially benign, though in a certain percentage of cases they recur. The extremely embryonic and cellular character of the periphery of these growths might certainly lead one at first sight to classify them as sarcoma; but from this they materially differ in that the cells do not maintain their embryonic character, but rapidly develop into mature connective tissue. Moreover, they are never associated with metastases, or infiltration of the surrounding lymphatics; and it would appear that when recurrence occurs, it is due not to a local malignancy, but to hypertrophy of another portion of the mucosa.

The embryonic blood-vessels in the actively growing cellular periphery, being ill supported by the surrounding stroma, are readily ruptured ; such is probably the origin of the violent bleedings which form so characteristic a clinical feature of these growths.

Another more uncommon variety of simple polypus found growing from the uterine mucosa is the **fibrous papilloma**. This is a purely fibrous tumour of a papillary form, covered by a single layer of epithelium. From the primary growth secondary offshoots are developed, each carrying with it an epithelial covering of cubical cells ; thus the gross appearance of the tumour shows a rough, irregular surface of cauliflower-like character. From the approximation of these papillæ, the interspaces closely resemble glands permeating the substance of the growth and opening on its surface ; but on microscopic examination their true structure is at once revealed. In a case described by Rindfleisch, small cavities lined with epithelium were found in the substance of the polypus, which he ascribed to the coalescence of the papillæ at their apices. The tissue of the tumour proper is entirely fibrous, with cells in all stages of development ; the centre is composed of well-formed fibres, while towards the periphery (as in fibro-adenoma) the fibres are more and more embryonic ; thus the centrifugal development of the neoplasm is demonstrated. These tumours are frequently described as "cauliflower papilloma" ; but as this name is more commonly applied to malignant epithelioma of like appearance, it leads to confusion, and should be dropped. Apart altogether from the nomenclature, they have been reckoned as closely allied to epithelioma ; but microscopic examination and clinical observation at once disprove such an affinity. Isolated cases, as those quoted by Wagner, may occur in which a simple fibrous papilloma by proliferation of its epitholial elements may subsequently develop into a malignant epithelioma. Such an event, however, can only be a coincidence. The transformation is far more likely to occur in the adenomatous types, where large numbers of epithelial cells are in active proliferation ; it is probable that in many instances this variety of growth may be the origin of it, and more especially the papillary type described by Semon (already mentioned), which is covered by many layers of squamous cells.

From what has been shown of their structure, it will be evident that all mucous polypi result from the increased growth of one or other of the normal tissues of the mucosa, namely, the glandular and connective tissues. They will, therefore, present an indefinite number of varieties of structure, entirely dependent upon the comparative excess of each ; and they are to be classed accordingly. At the hands of some authors they receive but little attention, and even by others are dismissed as mere local inflammatory excrescences. Doubtless such a classification may be simple and convenient, but as a scientific description it cannot be too strongly condemned. If consistently adopted, uterine fibromyoma must be looked upon as localised metritis, and ovarian fibromyoma as a kind of ovaritis. It is surely strange that the mucous growths of the uterus should be thus summarily dealt with, while similar conditions of the mamma, nose, and intestines are described as definite and independent neoplasms.

Symptoms.—The ever-present symptoms to direct the attention of patient and physician to mucous polypi are leucorrhœa and hæmorrhage. The former is perhaps the more characteristic, and sometimes occurs in almost incredible quantities, associated with much irritation and pruritus vulvæ. Its character varies: generally it is clear, watery, and odourless; but it may be muco-purulent. There is but little tendency to that necrosis of the tissues of the tumour which gives the characteristic fœtid character to malignant papilloma. Hæmorrhage also is often profuse, and is by no means confined to the menstrual periods, metrorrhagia being particularly frequent. The source of bleeding is not far to seek when it is remembered how feebly supported are the numerous embryonic blood-vessels in the periphery of the tumour. At the same time the menorrhagia is probably increased by the irritation set up by the tumour.

Unlike fibromyoma polypi may occur at all ages; and this feature forms, perhaps, the most interesting practical point in their consideration. Occurring, as they often do, late in life, many years after the menopause, they give rise to the alarming symptom of post-climacteric bleeding, and form the large majority of the few cases in which this symptom is not due to malignant disease. We have seen that they may occur on any portion of the uterine mucosa, but they are most frequently met with in the cervical canal. Their size is usually less than that of a walnut, and they may assume most varied shapes. In most instances they are smooth and soft, though in the papillary type the contrary is the case. As has already been shown, they have a marked tendency to recur after removal; but on this account alone they cannot be called malignant.

When palpable, their diagnosis is as a rule easy, although the determination of simple papillary growth from papillary epithelioma can never be made with certainty without microscopic examination.

When completely intra-uterine, their presence is frequently not suspected, and patients may be treated for long periods for leucorrhœa and uterine hæmorrhage, with slight uterine enlargement, till finally o dilatation of the cervix their presence is disclosed. Severe leucorrhœa and uterine hæmorrhage always indicate an early digital exploration the uterine cavity.

Intra-uterine polypi, and particularly the variety called "endometrit fungosa," may, from their tendency to cause post-climacteric hæmorrhag be difficult to distinguish from intra-uterine cancer; a decision can be ma by the microscope alone, when the absence of active typical epitheli proliferation in the glands will be noted. Malignant disease of t uterine body is commonly associated with pain, which is seldom prese with mucous polypi, unless of large size.

Although in their recurrence after removal they still more clos ly simulate malignant disease, they never give rise to secondary metasta es, nor are they associated with marked cachexia.

Treatment.—This is generally to be summed up in the word removal. When small, pedunculated, and projecting, through the cervix, this can easily be done by torsion or evulsion, with subsequent cauterisation of the site by Pacquelin's cautery. This latter procedure is useful, not only in arresting the hæmorrhage, which may be extremely severe, but also in so destroying the base that recurrence is prevented.

When large, their removal is most easily effected by scissors, as in the case of submucous polypi. The stump should, however, if possible, be thoroughly cauterised in all cases.

Intra-uterine polypi necessarily require previous cervical dilatation.

As these neoplasms have been known to be the forerunners of malignant disease, and also in some instances to recur locally, a chance is given to injudicious advocates of hysterectomy to remove the uterus. Unless positive signs of malignancy exist such a procedure is wholly unwarrantable.

I have more than once been called upon to remove successive growths of this kind from the same patient, and I can recall two well-marked cases. Five years ago, for the fourth time within eighteen months, I removed from a patient aged fifty-nine, still alive and healthy, a large number of intra-uterine adenomas, which had given rise to severe uterine hæmorrhage, and which from the microscope alone I knew to be of simple nature. In the other case, a young woman of twenty-three, I removed, for the last time, seven years ago, and three times within two years, a simple adenoma of the cervix; since then she has had perfect health, has married, and borne four children. After removal of intra-uterine adenomas, cauterisation of the interior of the uterus is most thoroughly and easily performed by means of fuming nitric acid, followed immediately by thorough intra-uterine irrigation.

Another variety of uterine polypus, but not strictly a new growth, is the **uterine hæmatoma or fibrinous polypus.** From its almost constant relationship to the puerperium it is commonly known as a "placental polypus," and is due to the deposition of blood-clot in successive layers upon a retained portion of uterine decidua or placenta. The blood tumour, thus formed in a stalactitic manner, subsequently becomes organised, and may remain attached to the uterine wall for months. During the time of its formation there is a constant hæmorrhagic discharge, and usually at the period of its expulsion severe and copious bleeding. Though rarely non-puerperal, in one case, fully described in *Edinb. Obstet. Transactions*, 1893, I met with a typical example in a non-puerperal patient, who suffered from intra-uterine fibro-adenoma; the case, so far as I can learn, is unique. The roughened surface of the tumour acts, doubtless, like retained portions of secundines, by causing coagulation of blood upon it. The polypus weighed 8 oz.

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MALIGNANT GROWTHS OF THE UTERUS

Introductory.—The task of setting forth the present state of our theoretical knowledge of malignant growths of the uterus does not include the consideration of the pathology of cancer in general. We have, however, sufficient material for a more definite and partial treatment of the subject.

Malignant disease as met with in the female sexual organs presents certain anatomical naked-eye changes of tissue, and a conformation of neoplasms which is peculiar to these parts; but, whatever their clinical importance, they are of comparatively little significance as pathologically distinct. But there are other questions—such as frequency of occurrence, causation, and surgical and medical methods of treatment—

which are highly important, and which require special consideration on account of the anatomical structure of the parts, the relations of the uterus to pelvic and other viscera, and its peculiar physiological functions.

The pathology is also to a large extent special on account of the minute anatomy of the parts affected, the relations of their constituent elements to the origin of the malignant process, the methods of invasion, and the extent of the changes produced by the growth of the neoplasm. For an exposition of the present state of the science of bacteriology in relation to malignant disease the reader is referred to *System of Medicine*, vol. i. We have to consider the practice of medicine as well as the pathology; and the two subjects are not always so mutually helpful and complementary as might have been expected. Some of the pathologists who have given special attention to this subject may be, perhaps, too prone to attach undue importance to their methods of investigation, to multiply non-essential details, and to magnify unimportant differences. They naturally become absorbed in the contemplation of the specimens which are to them the subject-material for observation and reflection; they are not so much concerned with the aspects of disease and its human interest. The clinician, on the other hand, has ever with him the human interest of the disease, and he looks sometimes impatiently towards the pathologist for practical guidance in dealing with the individual case. It is to him of small interest what name the nomenclature of the decade assigns to a certain conformation of epithelial or connective tissue elements. He wishes to know whether the disease in question is malignant or benign; and he may occasionally be harsh and unjust in his judgments of scientific pathology when the answers are not so prompt and lucid as he may have expected.

Cancer of the uterus, as popularly understood, implies the existence of a growth or tumour whose most striking characteristics are:—the tendency to spread by sending out roots in all directions from the point of origin, so as gradually to destroy the womb itself; and in the process to produce such symptoms as intense pain and foul discharges, distressing to the patient and those about her, and finally to cause a lingering and miserable death. The popular notion of pain as an essential symptom in such a terrible malady interposes one of the principal difficulties to effective treatment.

Another popular notion, which I fear is also held in some vague and uncertain way by many members of the medical profession, is that the menopause is associated with irregular and profuse hæmorrhage from the uterus, and even with other discharges from the uterus or pudenda. This widely-accepted theory of a final "cleansing," as a disagreeable episode demanding patient waiting for its termination, is one of the principal reasons why long delay so often occurs before women affected with cancer of the uterus seek professional advice. Abnormal phenomena such as irregular hæmorrhage at or about the menopause imply undiagnosed disease, and should lead to immediate and thorough examination.

In order to formulate our knowledge, to facilitate the description o symptoms, and to indicate the sequence and relations of processes an phenomena, it is necessary for us to classify the most striking form which malignant diseases of the uterus assume. We must constantl keep in mind, however, that these classifications apply with any pr cision only to the comparatively early stages of the disease; and we must also remember that the terms which we employ only indicate the presence of pathological tendencies producing certain tissue changes. The ultimate facts determining their origin and their relationships are still unknown to us. The malignant diseases that we call epithelioma, carcinoma, and sarcoma may all be present in the same individual. This coexistence of disease in the various forms implies, so far as we know, no more than a greater measure of some condition of the general health determining degenerations of which our exact knowledge is very limited.

The classification of the malignant diseases of the uterus which will be adopted here as most suitable to the present state of our knowledge, and as most convenient for exposition, is the following:—(1) epithelioma et carcinoma portionis vaginalis uteri; (2) carcinoma cervicis uteri; (3) carcinoma corporis uteri; (4) adenoma malignum corporis et cervicis uteri; (5) sarcoma corporis et cervicis uteri. The varieties or subdivisions of each form will be described and discussed in their proper places. Endothelioma of the uterus is as yet purely a term in pathology and has not acquired any interest from the clinical point of view.

I. Cancer of the Vaginal Portion of the Uterus

Pathological Anatomy.—The pathological anatomy of cancer of the vaginal portion and cervix forms a very difficult and extensive chapter in any adequate description of malignant disease of the uterus. The mass of published observations, both clinical and histological, is so enormous, and the views of pathologists who have devoted much attention to the subject are so diverse and even contradictory, that at first sight it is difficult to detect any sort of order in the chaos. When we remember, too, the great amount of controversy which has taken place on almost every detail of published observation, and the impossibility for each author or expositor, for the time being, absolutely to divest himself of some preconceived opinion or bias, we may readily conclude that the easiest and perhaps the best course is to rest satisfied with endeavouring to record concisely the state of knowledge and opinion at the time of writing.

The vast mass of observation and opinion previously on record has been greatly increased within recent years, when the bulk of the pr fession in Europe and America has declared so steadily in favour extirpation in the treatment of malignant disease of the uterus. N only has exact clinical and macroscopic observation become more co fident, exact, and practically useful, but the material obtained for th histologist and pathologist in comparatively early stages of the disease b ans of operation has become vastly more various and interesting, as l as incomparably greater in amount. To the same cause also we e it that clinical observation and histological investigation have ome more closely associated. We may ask whether progress in the uisition of exact knowledge of the pathology of uterine cancer has n great in proportion to the facility of obtaining material and ociating the observations with the history of individual cases; and ether the progress of pathological knowledge has corresponded with ater precision of diagnosis and treatment by the practical gynæcolo- ? On this point, it must be confessed, there is much reason to wer with hesitation. And yet there is a good deal in what appears description of personal observations which must have contained an ortant element of inference; and it may be alleged without undue ness that some conclusions offered by the pathologists, and given ctical effect to by the gynæcologists, have not been justified by the ct clinical observations of recent years. We may safely assert that expectations founded by practical men upon the earlier investigations the ultimate tissue-origin of cancer of the cervix have been doomed disappointment; and that little guidance has been obtained in the tment of the disease. Still all careful observations, however remote n obvious practical ends, must be welcomed and studied.

For the present purpose we must keep in mind that the cervix uteri sists of (1) a vaginal portion, and (2) a supra-vaginal portion extend- to the isthmus, where it joins the corpus uteri. The vaginal portion jects as a dome or truncated cone from the vaginal vault, and is, en normal, firm and resistant to the touch, and perfectly smooth, ce the terms os tincæ or *museau de tanche*. On visual inspection the liparous vaginal portion is found in health to be of a pink colour; the appearance of its surface confirms the impression of smoothness en to the sense of touch. It is planted, as it were, in the centre of vagina, and around it there is an indefinite boundary, where the ooth mucous covering of the vaginal portion merges into the rougher l harder vaginal lining. The existence of this boundary is, I believe, oint of some interest and importance in the spread of epithelioma of vaginal portion. The os externum, or opening of the cervical canal, the most striking feature presented by the vaginal portion. In the rfectly normal nulliparous uterus it may be oval or round; its edges indicated by the deeper colour of the margin of the cervical mucous ing, which generally can be more or less distinctly seen, and it is uated rather behind than at the centre of the most prominent spot, ause of the slightly greater bulk of the anterior lip. The parous, or ltiparous os externum when the uterus is in a state of complete olution, may vary considerably within the limits of health. The er is seldom free from marks of injury: there are fissures, more or deep; retention cysts, some of which may have ruptured, giving to the appearance of small or minute ulcerations; others may have ed or shrivelled up, producing minute white specks on or just within the apparent margin of the cervical canal. The area of exposure of the red cervical lining is invariably larger in appearance than in the nullipara, chiefly because the os is more open. Deeper fissures or lacerations producing lobulation of the vaginal portion with ectropium, hypersecretion, induration with prominent retention cysts, increase in volume, and other related changes, should be looked upon as pathological conditions. Between this higher limit of deeper-coloured lining about the os, and that lower limit where the smooth and soft mucosa shades off into the comparatively hard and rugated vagina, the portio vaginalis has been aptly described by Sir John Williams "as a cap of stratified epithelium, resembling a tailor's thimble, which fits on the lower end of the cervix proper." The layers of epidermis in health conceal the vascular papillæ; but the presence of these is obvious to the naked eye in the early stage of catarrh of the portio, by the scarlatinal appearance of the reddened mucosa from which the epidermis has been partially shed. In health this mucous covering can be felt to glide to a minute extent over the firm muscular mass of the cervix underlying it, and in some diseased conditions it can be readily peeled off, like wet paper, so as to expose the corium with its torn and bleeding papillary vessels underneath.

Between the vaginal portion with its squamous epithelium, and the true cervical mucous membrane with its cylindrical epithelium and innumerable gland structures, there is a narrow band where the epithelium is transitional, chiefly of a cubical form, and the glands fewer but still numerous. The existence of a debatable border, or belt, which may in diseased conditions be invaded from above by glandular or papillary structures resembling carcinoma, or from below by the squamous epithelium of the portio, has been too readily accepted by the gynæcologists from the pathologists. In support of the existence of this variable belt, it is said that there is occasionally great difficulty in making out the line of demarcation between epithelium of the portio vaginalis and cervix. This line is, however, almost certainly much more constant than is so often stated, even when on simple inspection it seems most obscured by the effects of exposure, of injuries, or of a catarrhal process. The cervical portion secretes an alkaline fluid, and the surface of the portio vaginalis is always moist with an acid exudation or secretion. If a piece of litmus paper be laid across the doubtful margin, which has been gently wiped with dry cotton wool, the dividing line will be always found exact and definite; the moisture on the reddened surface of the apparent portio is always acid, that of the area of cervical lining, even when obscured by ulcerating retention cysts or ectropium, is always alkaline. This test may be applied with advantage in an old laceration of the cervix with hypertrophy and flattening out, and erosion by contact with the vaginal wall. It is a guide to boundaries, and may show how much has to be done to restore the vaginal portion by operation. With regard to the mucous membrane of the cervix it may be best to quote the following description:—It "is much firmer and more fibrous than that of the body. Between the rugæ of the arbor vitæ there are

merous saccular and tubular glands. In the lower part of the cervix
e mucous membrane is beset with vascular papillæ, and the epithelium
stratified, but in the upper half or more the epithelium is columnar
d ciliated like that of the body. The glands, which are short, with
rge lumen, are everywhere lined with columnar ciliated epithelium,
en where the epithelium of the surface is stratified. Besides the
llicular glands there are almost constantly to be seen the so-called
ula Nabothi, clear yellowish vesicles of variable size, but visible to the
ked eye, embedded in the membrane" (37).

In describing the relevant points in the structure of the parts under
nsideration, there is one more margin or boundary which should be
entioned as of interest in relation to cancer of the cervix. This is the
per termination of the cervical canal where it is marked off by a con-
riction, the os internum, beyond which the cavity of the body begins.
st below the narrowest point, at the junction of the canal of the cervix
d of the body, there is a narrow band of mucous membrane, which in
ructure more nearly resembles the mucosa of the body than that of the
rvix. Küstner says of this border line that microscopically no differ-
ce can be made out between ½ cm. of the cervical mucous membrane
d an equal measure of the corporeal lining immediately adjoining,
her as regards the form and arrangement of glands or the form of the
lls. It is just at this narrow circle of tissues in the transition stage
tween cervix and body that the malignant ulceration spreading from
ithelioma of the cervix appears to be arrested to a very great extent,
d when checked to extend more rapidly, and to a larger extent, into
e muscular substances of the uterus and the parametrium.

The check to the process of ulceration at this spot, and the irregular
pertrophy from cell proliferation which takes its place, are probably
e immediate causes of the pyometra which is so frequently met with
fairly advanced post-climacteric cases; and the obstruction produced
hypertrophy must be a factor in the production of pain as a symptom
advancing cancer of the cervix in younger women.

Elements of origin of the disease.—The discussion of the ultimate facts
the origin of malignant disease of the portio vaginalis and cervix
eri does not help us much either in theory or practice. The differences
opinion amongst the pathologists are too marked to make it possible
r those who have not specially worked at the subject to form an
telligent judgment; and in practice, while there is room for fearing that
e plausibility and symmetry of some theories have led to practical
plications not altogether satisfactory, the vast mass of detailed descrip-
on, and the conclusions drawn from microscopic observations by patho-
gists, are not so far accepted as exact and well established as to warrant
nfident practical conclusions on the part of the gynæcologist. Most of
e theoretic teaching may be looked upon as merely the application of
eories of cancer in general to the uterus in particular.

Whether the ultimate facts be some change occurring in connective
ssue cells alone, or in epithelial cells, we do not yet know. It is still true,

as stated by Gusserow (14), that our comprehension of the anatomy of malignant tumours has been greatly obscured by the multiplicity of observations, and by the discussions on the point of origin of cancerous tumours. So far as I know, Virchow was the author of the theory of the connective tissue origin of carcinoma of the cervix, and with the name of Waldeyer we associate the opposing view that previously existing epithelium is the starting-point. Both conceptions recognise the epithelial character of cancerous growths, whether we call them carcinoma or epithelioma. Klebs supported the theory of the epithelial origin of malignant disease of the cervix. The transitional or cubical epithelium just within the os externum begins to proliferate, penetrates into the stroma of the mucous membrane, and even into the underlying muscular tissue, and causes occlusion or destruction of blood-vessels, and consequent necrosis and loss of substance within the vaginal portion and cervix. The squamous epithelium of the portio vaginalis, especially the cells of the *rete Malpighii*, becomes the seat of papillary hypertrophy; there is in the same way invasion of the subjacent structures, and consequent necrosis and breaking down. Thus originate the cancerous ulcers and papillary growths of the vaginal portion. With regard to carcinoma of the cervix, Klebs maintains that it is also of direct epithelial, not of connective tissue origin, as was formerly believed. The starting-point is in the epithelium of constricted cervical glands; and he assumes a tendency of the ovula Nabothi in the vicinity of the internal os to undergo cancerous changes.

Ruge and Veit, whose work has received so much attention, maintain that the pavement epithelium of the portio is never the point of origin of epithelioma or cancer of the vaginal portion; not even of the "cauliflower excrescence." The starting-point is either in the deeper connective tissue or in the newly-formed glands found in their follicular and papillary "erosions." Hence the seat of origin of this cancerous growth is outside the os externum, and it does not extend towards the cervix; its development is towards the vagina and parametrium—a conclusion carrying serious results. The connective-tissue stroma becomes vascularised and passes into the embryonic condition, and the new cellules assume an epithelioid aspect. Exceptionally, these authors have seen adenomatous vegetations of glandular epithelial origin give rise to carcinoma; but they never saw plugs of epithelium extending down into the connective tissue. So, symmetrically as it were, it is the connective tissue of the walls of the cervix, or the glands of the mucous membrane, which is the point of origin of carcinoma of the cervix. They assert that this is the origin of a form of malignant disease of the cervix which does not extend downwards outside the os externum, but spreads all round, destroying the cervical tissues and extending readily upwards to the body of the uterus.

Seat of origin of growth in its earliest clinical aspect.—From the investigations and hypotheses already mentioned it would be easy to infer, in anticipation of clinical observation, that in the anatomical sense there must be three positions in which the earliest appearance of cancer of the portio and cervix may be made out: (1) As small nodules deep in the tissues of the vaginal portion with the squamous epithelium still unbroken. This view follows the hypothesis of Ruge and Veit as to the deep-seated connective-tissue origin even of papillary growths, although such growths apparently arise from the squamous epithelial surface of the portio vaginalis. (2) As a shallow ulcer on the surface of the vaginal portion, a feature due to the origin of the new growth in the most superficial part of the connective tissue under the pavement epithelium, or in the "erosion," follicular or otherwise, which in structure and position is a new growth, and is capable, according to the hypothesis, of assuming malignant characters. The process thus originating attacks by preference only the surface of the vaginal portion, and extends towards the vagina, never upwards through the os externum. (3) As a nodule or nodules within the os externum, and underlying the mucous membrane, through which the minute malignant growth ultimately penetrates, producing necrosis. This form is the clinical result of the malignant process which starts in the connective tissue of the wall of the cervix just under the mucosa, and it spreads readily along the cervical canal, but not downwards beyond the os externum.

During the last five-and-twenty years I have endeavoured to examine cancer cases with some precision, and keeping these theoretic opinions in mind as they were published, I have sought for early cases even when symptoms did not suggest the presence of malignant disease; but I have never seen a case of flat ulcer, of papillary growth of the portio vaginalis, or of carcinoma of the cervix, in which the os externum was not involved. Some of the cases have been in the earliest clinical stage, with only a very small amount of friable material outside or inside the os uteri; and in all such cases the appearances on examination pointed to the margin of the os externum—the belt of transitional epithelium—as the site of origin of the growth.

From what has been said, it will be inferred that my conclusion is that the distinction usually maintained between cancer of the portio and of the cervix is an arbitrary one, and that it is not supported by the facts of cases observed in practice.

Among others, Leopold maintained the same opinion. In a discussion on the diagnosis of cancer of the body of the uterus, he supported the theory of Waldeyer, Thiersch, and others, that cancer can only be defined as an atypical epithelial neoplasm; and he endeavoured to prove that to separate cancer of the portio from that of the cervix is not in accordance with the facts, and is indeed impossible. "Carcinoma of the uterus occurs most frequently below the os internum, commencing in the epithelium of the portio vaginalis; seldom in that of the mucous membrane of the cervix. A large number of cases of so-called carcinoma of the cervix are really cases of carcinoma of the portio vaginalis."

Modes of extension of the malignant growth.—Without trenching upon the ground that must be gone over in dealing with the course and symptoms of the disease, it may be well here to consider shortly the modes, including directions, in which the disease spreads in its later initial stages and the forms which it assumes.

Epithelioma of the portio vaginalis, when it takes the form of flat cancroid or ulcer, spreads impartially upwards and downwards. The shallow ulceration downwards is most apparent comparatively early, because the lip affected long retains its shape, however it may change in size and in colour; but any firm manipulation of the affected cervical area, such as the application of a sharp curette, at once reveals the extent of the invasion. I have before me microscopic preparations of tissue taken from the clear-cut margin of a shallow epitheliomatous ulcer where it had just reached the vaginal vault in front. There is healthy tissue at one end of the section and cancerous tissue at the other. The surface of the ulcer was clean-looking, and the whole process seemed superficial; but the cervical canal was excavated into a wide crater, and the whole uterus was fixed by infiltration of the parametrium. The superficial ulcer which destroys the surface of the portio vaginalis, the area of soft squamous epithelium, does not seem readily to invade the region of the more cornified epidermis of the vagina. The tissues encountered at the line of transition of the epithelium seem to exercise a certain retarding influence.

At the external os the process of necrosis, as a rule, destroys the mucous lining rapidly, and penetrates more or less profoundly the muscular tissue of the vaginal portion, although the muscular tissue offers greater resistance to invasion than does the mucosa. But beyond and within the os externum the mucous membrane disappears at a more rapid rate than the muscular and fibrous tissue arranged round the os, and, consequently, even comparatively late, there may be a relative narrowness and firmness of the parts representing the original os externum. The process of ulceration continues, creating a sort of funnel-shaped cavity in place of the normal cervical canal, and ultimately reaches the neighbourhood of the os internum. Here, again, there is a comparative arrest of the process of necrosis, only more marked than that which is found at the junction of the vaginal portion and vagina, or even at the external os. In not a few cases the resistance to the ulcerative process is so great that considerable hypertrophy, both of epithelial and parenchymatous elements, may result. This hypertrophy in post-climacteric cases sometimes produces a complete closure of the os internum, bringing about the condition of hydrometra which, probably by bacterial invasion, ultimately becomes pyometra—by no means a rare complication of post-climacteric cancer of the cervix (*vide* p. 264).

In the papillary form of epithelioma of the vaginal portion the disease begins on the margin of the external os. The earliest development of the tumour which ever came under my notice was that of a small growth with the characters of cauliflower excrescence. It was growing from the margin of the os externum, and the cervical tissue itself did not appear to be invaded. Considering all the circumstances of the case, the operation of total extirpation was recommended and performed, and after operation it was found on incision at the external os that the cervical tissue was invaded nearly symmetrically all round, and the uterus, as a museum specimen at the present time, shows a distinct funnel-shaped excavation where the soft papillary growth originally existed. In every case of cauliflower excrescence, even when the mass in the vagina is enormously large, the uterus itself is found to be movable and extirpation appears to be feasible. So far, then, as the spread of the disease is concerned, in a case of papillary epithelioma it may be confidently alleged that invasion of the cervix is early and constant, and that infiltration of the parametric connective tissue occurs comparatively late.

When invasion of the parametric tissue does occur in cancer of the vaginal portion or cervix, the areas first infected are almost invariably in the sacro-uterine folds; not in the broad ligaments, as one sees so often asserted. It is wonderful in the examination of a doubtful case how distinctly the extent of this invasion may be made out. When considerable ulceration has occurred, and especially if there has been early infection of the uterus with saprogenic organisms which produce an offensive odour, no decision as to operation or prognosis should be given without a careful exploration of the pelvis per rectum. This cannot be done efficiently until the bowels have been properly prepared, and the patient has been put under an anæsthetic. It is then possible to make out with marvellous distinctness the position and size of the various parts of the uterus and its relations; and if the slightest infiltration has occurred in a sacro-uterine fold, or anywhere else, it can hardly be missed. The condition of one or other fold—and it is always one or other in such a case, never both—is often that of a curved line of irregular nodules. These swellings are rightly assumed to be produced by glandular infiltration and enlargements. It is chiefly the gradual development of this invasion of the sacro-uterine folds which brings about fixation of the uterus.

The clinical form of the disease at a comparatively early stage, sometimes called mushroom growth, arises from hypertrophy of the parenchyma of the cervix, with softening owing to infiltration of cancerous elements. It is almost always a carcinoma of the cervix uteri, and its site of origin is within the os externum. It marks a stage of the development of the new growth at which the uterus is almost invariably movable.

The later stages of cancer of the vaginal portion or cervix may be more suitably taken under the symptoms and progress of the disease than in treating of the pathological anatomy.

Etiology.—In no portion of the field has greater industry and intellectual effort been expended with less satisfactory returns than in endeavouring to get at the causes of malignant disease of the uterus. The object sought for has been some clue to the intimate nature of cancer, with a view to prevention and rational treatment. This is a pursuit for the general pathologist, not for the specialist in diseases of women, but there are well-ascertained facts with regard to malignant disease as it affects the female sex which give the study of etiology a special interest to the gynæcologist.

First, as to frequency of occurrence, malignant disease affects the uterus in a very large proportion of all the cases observed; and to this preference is due the rule, well established by statistics, that women are much more liable to cancer than men. Such statistics are easily available for reference, and need not be quoted in detail. The older compilations of figures may be found in Gusserow's classical work on the *New Growths of the Uterus*, and some others will be referred to in the sequel. Statistics proved before Simpson's work that in England, between forty and fifty years ago, about twice as many women as men died of cancer. Simpson showed that malignant disease was about equal in the sexes at or about the age of fifteen; and from this period of life the difference became more marked until between the ages of forty-five and fifty-five, when the proportion of women to men affected was as 3½ to 1; and then it began to approach a more equal distribution.

When we come to the particulars of sex and organ attacked, we find that cancer of the uterus takes the most conspicuous place. Schroeder found that of 19,666 women who died of cancer, 6548 were affected with carcinoma of the uterus. Similar results were brought out by E. Wagner on investigation of the post-mortem examinations in Vienna, Prague, and Leipzig.

In this country, more recently, Sir Spencer Wells again analysed the statistics and obtained results, as compared with Simpson's, which suggested an increase in the frequency of malignant disease, with a still higher ratio of women to men. Leaving aside these general results from the examination of vast numbers (32) of cases, we must look to details for assistance. Oskar Müller analysed in great detail 577 cases of cancer of the uterus which were observed at Gusserow's clinic, and brought out some very striking facts which suggest more definite conclusions.

A defect observable in all these analyses, one which greatly lessens their value when looked to for practical hints for light on the etiology, is the grouping together of all forms of malignant disease of the uterus. But, so far as causation is concerned, cancer of the portio vaginalis and cervix may be looked upon as a disease quite distinct from carcinoma of the body of the uterus, or sarcoma in either body or cervix. Carcinoma of the body is a comparatively rare disease found under conditions strikingly different from epithelioma of the portio. It may be put down for the present at about 4 to 5 per cent of all cases of carcinoma of the uterus. The proportion of cases of sarcoma is at present an unknown quantity. The cases are practically included in the figures for cancer of the body, and therefore they amount to a small fraction of the 5 per cent.

Taking the figures which have been compiled as we find them, and applying a logical method of induction by looking for some constant point of agreement amidst the bewildering differences presented in the analysis of a large number of cases, we are struck with the agreement within limits as to the age of the patients. The great majority are women past the middle period of their sexual life, if that be reckoned as from 15 to 45, and many are beyond it—past the menopause. Gusserow puts together the figures of certain writers, whom he mentions, and reaches a total of 3385 cases of cancer of the uterus. Of these women only 2 were under 20 years of age; and we may fairly assume that these were cases of sarcoma. Of the whole, 1169 cases occurred between 40 and 50, and 856 between 50 and 60. When we make allowance for the fact that the number of living women rapidly decreases from decade to decade of their age, we see that the number of cases between 40 and 60 forms a very large fraction of the whole. Oskar Müller found, in the 577 cases which formed the subject material of his contribution, more than one-third of the patients were under 40 years of age, and in no case was the age under 20. In 100 consecutive cases in the out-patient department of the Manchester Southern Hospital, I found 77 cases sufficiently detailed to be safe for reference. Of these one was under 30, 23 were between 30 and 40, 28 between 40 and 50, 21 between 50 and 60, and 4 between 60 and 70. There was no case over 70.

We may consider the influence of age as completely demonstrated: 50 years is the age at or about which the climax is reached. Age suggests lowered vitality and tendency to degeneration, but speculations in this direction have led to nothing. The deteriorated vitality of the tissues is common to all women of the same age, whether cancer is to appear or not.

Narrowing down from age to race, we find a suggestive point. It may be considered as proved beyond doubt that cancer of the uterus is much less common among the negro races, and even among Asiatics, than it is among the white races. This result seems to imply that persons more highly organised intellectually and morally are rather more subject to this scourge than those who are hereditarily more callous, or less intellectual or imaginative. Those who are capable of looking "before and after" suffer from carcinoma of the uterus. The aborigines of tropical Africa are well known to be almost or altogether immune.

If we now come within still narrower limits, from race to class, we meet with a still more striking fact. All observers are agreed that cancer of the uterus (without distinguishing the cervix, which would make the exceptions still fewer) is most frequently met with in the lower ranks of the people of all countries. So marked is the difference of incidence, that it might be reasonably affirmed that if we could place all the lower orders who suffer from privation and depressing environment for a generation or two in the position of the more favoured, we should stamp out cancer. In his analysis of 577 cases Oskar Müller found that the patients were almost exclusively of the labouring class. My experience is that cancer of the portio and cervix occurs only among the working-classes; the apparent exceptions are few and usually explicable by the personal and family history. A German reviewer speaking of an article (28) in which it was stated that lacerations of the cervix were the chief cause of cancer, and hence the frequency of cases in Germany as compared with America, suggests that the comparative immunity of American women depends upon their better social conditions (*Wohlhabenheit*).

Keeping in view age and class, we proceed still further to eliminate irrelevant points, and we find that child-bearing has some relationship to the causes of cancer of the portio and cervix. Nulliparous women are almost immune. Winckel (56) puts his experience on this point very concisely: "The large majority of women with uterine cancer are married. Of my patients only 1·7 per cent were unmarried, and two-thirds of these had given birth to one or more children." The highest proportion of nulliparæ affected with cancer of the uterus which I have seen mentioned is that found by Oskar Müller, namely, 5·3 per cent. The number of cases of cancer of the body of the uterus is not deducted. The proportion of nulliparæ suffering from cancer of the cervix occurring in my hospital practice is slightly over one per cent. Cancer of the body, on the other hand, occurs almost exclusively in the nulliparous. When we follow such suggestions as possible causal relations between cancer of the uterus and constitution, temperament, occupation, previous illnesses not connected with infection or traumatism of the sexual organs, anomalies of menstruation, sexual excess, and such like, we can find no trace of a constant factor.

What then about heredity, which has taken such hold upon the popular imagination? In reference to cancer of the uterus it appears to be a factor of little etiological importance. In Oskar Müller's analysis of Gusserow's later cases it hardly appears. Gusserow collected 1203 cases, including his earlier material, and found only 90, or 7·8 per cent, in which cancer might have been produced, among other causes, by hereditary tendency. Picot found a hereditary predisposition in 13 per cent of cancer of all organs. But it should be remembered that to trace heredity among the class of women usually affected with cancer of the cervix is a difficult task. Genealogy is not a strong feature in the acquirements of their class; it is often very difficult to get with precision even the most elementary facts in the history of the individual patient herself. Heredity, at any rate, has not been shown to be an important factor in the production of cancer of the uterus.

Setting aside irrelevant and questionable evidence as to causation, we find some striking points which are fairly constant: (1) *the race*, one highly developed, although the class attacked does not consist of the highest specimens of their race: (2) *the social class* whose lives are the most laborious, monotonous, and careworn of their community; (3) *the domestic relationships* of marriage and maternity; and (4) *age*, a certain limited period of the individual life. The age is that of the decay or extinction of the functional activity of the sexual organs, and of diminishing vitality of the tissues in general. The domestic circumstances and the class of the sufferers imply a vast amount of unhappy experience of life.

On the physical side there is the constant drain on the constitution of frequent pregnancy and lactation, sometimes both combined at the same time; for many of these women go on suckling their children partly for the sake of economy, partly because they believe lactation prevents conception. Parturition implies injury to the cervix uteri, and not unfrequently still further drains upon their strength by puerperal illness. There are to be included almost invariably, also, irritation and consequent discharges from the injured cervix and vaginal portion of chronically filthy genitals. In addition there is the loss of rest from nursing sick children, and the constant clamour of those who are well. Many of the women of the class under consideration live laborious lives in doing domestic work, or as the breadwinners of ailing, lazy, or dissipated husbands. We must also keep in mind the chronic deficiency of nourishing food and of suitable clothing, and that many live under the most insanitary conditions of their own making, which no local regulations can prevent. Too frequently, also, bodily exhaustion and mental depression lead to the use of bad alcoholic stimulants, and when food is not plentiful the line of excess is easily reached. Alcohol under such conditions produces a chronic metritis which is quite characteristic.

On the emotional side there are constant care as to pecuniary means, worries from interrupted employment, anxieties from the illnesses of husband and children, and grief from frequent fatal termination of illness in both young and old. Eighteen per cent of the women whose cases I inquired into with special reference to the loss of children were widows. Add to all this the depressing monotony of the lives of such women; the lives of their men are by comparison interesting and free from care.

But, it may be asked, what has all this to do with cancer of the cervix uteri? The relation to physical and mental depression, combined with local lesions, is not very remote. With some effects of emotional conditions upon the uterus we are quite familiar. We know that violent emotions produce interruptions of pregnancy, and many illustrations of minor injuries directly due to violent emotion might be quoted if space permitted. It stands to reason, therefore, that the griefs and smaller depressing emotions—from bereavement by death to domestic quarrels and insults—by which the women suffer, and on which they brood without alleviating distractions, may in time produce serious results by a sort of integration of the effects of emotional storms, comparatively frequent and therefore little noted.

Coming to more definite details as to factors modifying nutrition, we have also to note the chronic irritation from lacerations of the cervix and chronic cervical catarrh. *Ubi stimulus, ibi fluxus.* Many gynæcologists have said that they have never obtained any evidence of a causal relation between laceration of the cervix and epithelioma. But have they not looked too much to the fissure and the cicatrix? A cervix that has been deeply lacerated undergoes very gradual changes, which show that the irritation exists not in the cicatrix, but in the whole of the vaginal portion; and the coincidence of epithelioma and "multiparous os" is too frequent to be explained as mere chance.

There is also in my experience a suspicious frequency of coincidence of malignant disease of the cervix and a history of gonorrhœal infection. Bumm has made a statement with which all gynæcologists who have paid special attention to the subject of gonorrhœa in women must agree. "The chief seat of gonorrhœa in the woman is the urethra and the cervix uteri; the infection of the cervix produces symptoms and distress only at the beginning: when it has once become chronic it may continue for years without causing trouble (Beschwerden)." Winckel (56) may also be quoted from among many authors who have given expression to a similar opinion: "It seems plausible that such specific diseases (gonorrhœal infection) favour the development of carcinoma."

The conclusion which the facts seem to lead up to is that cancer of the vaginal portion and cervix is very largely a *morbus miseriæ*. What the import of the apparent exceptions may be I do not profess to understand, but it seems probable that if the conclusion be in the main true, the exceptions when understood will support it. While heredity in the individual is obscure or apparently feebly indicated, there may be in the exceptions the expression of the hereditary sufferings of the class; the comparatively well-cared for individual of her generation requiring comparatively little of a determining cause to bring out that which might have appeared in the former generation but for the absence of the immediate local cause. The hypothesis of *morbus miseriæ* places cancer of the cervix in the same category as leprosy, and to some extent of mollities ossium and pellagra; and by analogy we may assume that cancer may be banished by social ameliorations which will raise the presently existing cancer-producing class to the higher level of the presently existing immune, just as the disappearance of the horrors in the individual lives and environment of past generations has made leprosy in England an historic disease.

The New Pathology.—Nothing of importance has been added to our knowledge of this subject since the following sentences were written two years ago; endless details, chiefly surgical, nothing more. It would take us too far away and for too long a time from the clinical consideration of the subject, to go into detail on the newer etiology and pathology of cancer in general, and of the disease as it affects the female sexual organs in particular. But it may be as well for the sake of completeness, and on account of their alleged bearings on the practice of to-day, to glance at the chief features of the more recent research and controversy.

Is the cause of malignant disease a vegetable parasite or blastomycete, as suggested by Russell ten or twelve years ago, and worked out by San Felice and many others? Are the "cancer bodies" animal parasites? a theory maintained by Gaylord, and supported by much persevering and ingenious observation and experiment. Is it an infectious disease most nearly resembling tubercle and syphilis? or is the cause still entirely unknown, or merely guessed at as possibly the result of local or general changes in the nervous system governing the growth, the nutrition, and involution of organs and tissues?

Leopold of Dresden, after several years of observation and experiment, placed the results of his labours before the profession at the International Congress held at Paris in 1900, and he returned again to the subject at the Congress of German Gynæcologists held at Giessen. His conclusions amount to this: That blastomycetes may be the cause of malignant new growths in man; that they may convey the disease by inoculation from man to animals, producing exactly similar new growths which are fatal to the animals affected. Among his experiments Leopold mentions the implantation into a rat of tissue from carcinoma of the ovary. The animal died in sixty-one days from a tumour the size of a walnut, which was found to be an adeno-sarcoma. It will thus be seen that Leopold, like some other experimenters, in order to support his conclusions, must give up the distinction between carcinoma and sarcoma. This may be right, and a step towards truth and simplicity, or it may only imply, which is most probable of all and certainly true, that it is not always possible to distinguish between carcinoma, sarcoma, and granuloma by the aid of the microscope alone.

In referring to this subject in a recent discussion, Menge expressed the opinion that such experiments produce merely granulation tissue with giant cells, and he further says: "If Leopold holds to his belief in the specific nature of his cancer-producers, he must admit the identity of carcinoma and sarcoma."

With regard to the parasitic hypothesis of cancer, some very confident statements come to us from America. At the last meeting of the American Gynecological Society, one of the speakers gave typical expression to our vague hopes and aspirations. In the course of a paper on Hysterectomy for Uterine Cancer, he said: "Are we not justified in the hope that the so-called parasitic theory of the origin of cancer may evolve something? The solution of the question depends upon the bacteriologist and pathologist. We can but look upon the subject with some seriousness when the great State of New York has considered it of sufficient importance to establish a pathological laboratory for the study of the etiology of cancer. Dr. Gaylord, of that institution, has reported that he has found the protozoon." During the discussion which followed, Dr. Matthew D. Mann, Professor of Gynæcology in the University of Buffalo, said: "I know the profession is not ready yet to accept the evidence of what has been done in Buffalo; but, personally, I feel quite convinced that in the State Laboratory the cause of cancer has been discovered." Of certain work in support of the yeast theory of the etiology of cancer it has recently been said: "Roncali apparently thinks the *ipse dixit* of enthusiasm is an adequate substitute for the details of a scientific proof." But here is apparently independent evidence from a witness of repute which is bound to arrest attention. Nevertheless, a witness who knows the facts, and whose evidence must weigh more fully with us than even the one just quoted—I allude to Senn, of Chicago—said even more recently that intraparenchymatous injections of animals were no use as a proof of anything, and that the parasitic origin of carcinoma has not been established by experimental research, bacteriological or histological, or by implantation or inoculation experiments. This year we have the report of the Cancer Commission of the Harvard Medical School. It informs us that the work done during the past two years in the study of the etiology of cancer has been wholly negative in its results, in the sense that an increasing doubt has been thrown upon the parasitic origin of the disease, and upon the pathological significance of so-called cell inclusions. An opinion is given that the long series of admirably conducted experiments went to show that the search for a cause of cancer has not been furthered, and is not likely to be, by a continued prosecution of research on the lines just mentioned. The Director of the State Laboratory at Buffalo says, on the other hand, that the results of the past year's work have been to strengthen the conviction that cancer is an infectious disease.

Even if it were possible to reconcile some contradictions, we are not in sight of any casual nexus between the clinical phenomena of the disease and the alleged factors in its production, and still further away from any hint of the bearing of the pathology at present in vogue upon any definite therapeutic measures.

The symptoms and clinical course.—In the early stage of cancer of the vaginal portion there are no symptoms which could indicate to the person affected the presence of a grave disease. There is nothing to interfere in the slightest degree with the ordinary course of life; and even if the woman's attention be attracted to certain trifling symptoms, her fears are not excited; thus it is very rarely indeed that the physician has the opportunity of observing a case even from the earliest onset of the symptoms. The chief symptoms, in the order in which they appear before their relations are obscured by the appearance of important complications, are hæmorrhage, a more or less offensive vaginal discharge, and pain. The hæmorrhage comes from the portion of the cervix uteri affected. It is seldom profuse. It appears rather as an irregular, slight, spontaneous hæmorrhagic discharge from the genitals, than as the immediate result of traumatism. The injury may be produced by straining owing to constipation, by sexual intercourse, or by some other cause implying direct interference with the part affected. In the married, hæmorrhage post-coitum is perhaps the most constant and suggestive ante-climacteric sign. The stimulus to the uterus resulting from the presence of the new growth may be such as to produce a noticeable increase in the amount or duration of menstruation, but this is not by any means a constant feature at any stage of the disease, and its extent has been probably much exaggerated.

In women who have passed the change of life hæmorrhage is still the first symptom of the disease; but then it usually attracts more attention, and leads, upon the whole, to an earlier demand for medical advice. However far advanced in years, the patient is apt at first to be satisfied in her own mind that menstruation has recurred. Post-climacteric pudendal hæmorrhage should always suggest malignant disease. Somewhat later in the course of the disease hæmorrhage may become profuse, and it occasionally continues in a slighter degree for weeks without intermission, producing anæmia and contributing largely to that condition which we call the cancerous cachexia.

The foul discharge is the second characteristic symptom of early malignant disease of the cervix. The discharge is at first entirely or comparatively inodorous. This is specially the case in the profuse discharge from the cauliflower excrescence before the growth has been interfered with in any way, either by the digital examination of the physician, or by the use of a syringe manipulated by the patient herself. The discharge from the cauliflower excrescence, even in the early stage, is profuse; but it is comparatively thick and slimy; it is neither serous nor purulent. In the earliest stage of all it contains numerous white particles, portions of the rapidly growing and necrosing epithelial elements. In the case of a superficially ulcerating epithelioma, or in the early stage of cancer of the cervix, the discharge is scanty, thin, and serous; but it soon assumes its characteristic turbid, dirty-water appearance, and its extremely offensive odour. As a rule it is a profuse discharge before it becomes a foul discharge. The discoloration of the discharge arises, no doubt, from minute extravasations of blood, the elements of which become darkened and disintegrated in the serous fluid, and under the chemical and bacterial influences at work. The offensive odour is produced by the changes which the serous fluid undergoes in oozing from the necrosing surfaces, owing to the access of air and external filth, and to the invasion of saprogenic organisms. When a serous offensive discharge has once been set up it is permanent; and however the hæmorrhage, or pain, or other symptoms may be modified by treatment, the foul discharge, except on total extirpation, persists more or less to the end. It may be modified only for a time by antiseptics, by curetting, and other direct treatment.

Pain, as a symptom of malignant disease of the portio vaginalis or cervix uteri, comes on comparatively late; and cases are met with in which the whole course of the disease has been run without the pain being so severe as to call for the administration of sedative drugs. It may be set down as a rule that when the patient at the first interview mentions pain as a prominent symptom, we may expect to find, on physical examination, that the disease is well advanced, and that the uterus is fixed, or at least in such a condition as to make radical surgical treatment impossible.

It has been so frequently observed that when there is rapid necrosis of the vaginal portion, producing an open cavity, the pain is slight, that we might almost generalise to the extent of saying that pain is in inverse ratio to the amount of ulceration. When the vaginal portion alone is affected there is no pain. The onset of pain appears to coincide with the invasion of the parametrium, and consequent interference with the mobility of the uterus. With regard to pressure on nerves or other interference with them we can only surmise. When the ulceration reaches the vicinity of the os internum, or somewhat earlier when the case is one of the hard form of cancer of the cervix, we hear of a genuine uterine pain. It is the dull aching in the sacral region which now becomes persistent. When pain is hypogastric and occasionally spasmodic there is reason to suspect occlusion of the internal os and the formation of pyometra. This is probably the explanation of the intermittent or colic-like character ascribed to the pain in some cases. It applies only to post-climacteric cases; in younger women the extension of the disease so as to interfere with the lumen of the internal os, or to produce rigidity of tissues in its neighbourhood, must obviously produce a characteristic discomfort amounting at the menstrual periods to considerable suffering.

Later still in the history of the case an element in the pain is interference with the bladder and bowel, or other organ to which the sense of pain is referred. And among the local causes of suffering we find sometimes, though not so frequently as might be expected, an irritation about the vulva from dermatitis or pruritus produced by the discharge.

If the patient live sufficiently long, there is added to her sufferings a constant dull, depressing pain from the extension of the disease to the peritoneum. The peritonitis is rarely acute, and the pain is often brought out only by palpation in the course of examination or treatment. It is a perimetritis, and it seldom extends beyond the pelvis, except as a final lesion due to some accident or rupture which makes it general and rapidly fatal. Perhaps the explanation of the low form of the peritonitis, and its comparative painlessness, is that it is always a late complication. The patient is then both anæmic and sapræmic, and from this physical condition arises largely a characteristic hebetude and apathy. Besides, the uterus at this stage has been long fixed by the infiltration, which also interferes with the ureters, and the resulting uræmia must add its contribution to the production of anæsthesia.

By the time pain has come on and the uterus is fixed we find another symptom which, in my experience, is constant; this is nocturnal rise of temperature. The temperature may be normal or subnormal in the morning, but it rises to 100° or a little higher at night; and later in the course of the disease there may be sudden temporary elevations to a much greater degree. The causes appear to be: (1) the parametritis—and in this respect it is much as we find it in a chronic inflammation of the circumuterine tissue without abscess formation; and (2) a certain amount of sapræmia from absorption at the seat of ulceration.

The absence of symptoms produced by sepsis, even of pyrexia, is remarkable, considering the foulness of the ulcerating cavity. It depends, in all probability, upon the fact that in the invasion of the tissues a stratum of non-infective infiltration precedes even the deepest layer which saprogenic bacteria have reached; and by this advanced stratum both blood-vessels and lymphatics are rendered more or less incapable of taking up and conveying the toxin. Hence, also, perhaps, the comparative rarity of metastasis from uterine cancer. The freedom with which the fluid products of necrosis of uterine tissues can escape no doubt also contributes to the same result.

Among the more general symptoms of cancer of the uterus must be mentioned the effects of the disease upon the digestive organs, which are almost constant. The most striking feature in this group of symptoms is the early occurrence of anorexia in case of the disease; how it arises has not been explained. It is obviously not from any direct effect upon the intestines. Later in the progress of the disease it may be associated to some extent with the sapræmia which exists during ulceration, even if the retention of débris and fluid be slight. At a more advanced stage we find that changes affecting the digestive organs occur as the result of pressure; this is when the disease has made such progress as to produce a certain amount of pelvic peritonitis, with paresis of the intestine, or constipation, by the mere mechanical pressure of the enlarged uterus or mass of parametritic exudation. In this interference with the functions of the intestines there are rarely any symptoms approaching in severity those which mark the tendency to obstruction, as observed in cancer of the bowel itself, or in pressure of the mass of tumour on the rectum in pelvic hæmatocele. There is a certain amount of paresis.

Vomiting may occur comparatively early, long before a mechanical cause for it appears to exist. It is not, however, a constant symptom until an advanced stage of the disease. In early anorexia it may be produced by injudiciously zealous feeding to keep up the strength, or by unsuitable food and by medicines.

Another member of this group of symptoms is irregular diarrhœa. As a consequence of the bowel irritation produced by the development of the disease, we occasionally find, not extreme constipation or partial obstruction, but painful attacks, with frequent mucous motions, lasting for several days, and amounting to diarrhœa.

With regard to the urinary organs, the symptoms in the earlier stages are not appreciable, whereas in the later stages much distress is almost a constant element in the case. In the early stage of cancer we may be unable to discover any bladder symptoms at all; later, when circum-uterine structures are breaking down, the ulcerations spread towards the bladder more frequently than towards the bowel. Long before the septum between the utero-vaginal canal and the bladder is broken down, there is cancerous cellulitis affecting the loose tissue between the uterus and bladder, and causing irritability of the bladder and frequent micturition. Later still, on making a careful examination in such a case, with the aid of a bladder sound, we find a suggestion of irregularity and hardening of the mucous lining of the bladder itself towards the uterus. Invasion is now sufficiently far advanced to produce vesical catarrh. Yet this is not the principal urinary trouble associated with cancer of the uterus. The principal trouble affecting the urinary organs arises from interference with the ureter, not with the bladder itself directly, or with the urethra. As the cancerous parametritis extends outwards in the broad ligament the uterus becomes fixed. Owing to the position of the ureters they are very liable to be subjected to pressure. The disease at first may be unilateral, or it may spread almost equally on both sides, and consequently the pressure may be on one ureter or both. Now the ureter in this cancerous infiltration is not displaced, as it may become during the growth of a fibromyomatous tumour. The ureter may be greatly displaced by the benign tumour, yet no marked symptom of kidney disease be produced. In the course of the cancerous infiltration the ureter is embedded, not pushed aside; the infiltration becomes harder, and the calibre of the ureter is encroached upon. This constriction of the ureter leads to dilatation of the tube higher up, and results in hydronephrosis, pyonephrosis, or some other of those changes which go on in a kidney the ureter of which is obstructed. The symptoms accompanying these serious changes may be comparatively slight, or there may be marked signs of uræmia. Sometimes when the patient may appear to be in danger from the uræmic condition alone, sudden relief may be obtained by rupture of the ureter into the ulcerating cavity of the uterus, and the establishment of a fistula. Such a method of relief, however, is not an incident to be counted upon, but it may be obtained by operation, and this has occasionally been done. If symptoms of uræmia once come on, we may, with confidence, conclude that the prognosis as to length of life is extremely gloomy. This is a point of the very greatest importance in dealing with advanced cases of cancer of the uterus, and specially with regard to prognosis.

When hard, nodular, non-ulcerating masses are found filling the pelvis, one or other kidney may be found distinctly enlarged, giving, perhaps, the impression of being cystic. This is all the more easily made out because of the emaciation characteristic of this advanced stage of the disease. This enlargement should be always looked for in the first examination of an advanced case. Extreme dilatation of the ureters is by no means a rare condition, as shown by post-mortem examination in uræmic cases, and in cases of veiled uræmia.

Late in the course of the disease we may find, as the result of the ulceration, fistula between the bladder and the ulcerating utero-vaginal cavity; this is an inevitable result of the cancerous process, if the patient live long enough. We may find recto-vaginal or recto-uterine fistula, which is a much rarer condition of parts than vesico-vaginal fistula; or fistula, both anterior and posterior, may be established, producing the condition of cloaca. By this time the patient is in a very miserable state owing to pain and the impossibility of preventing discharges, foul smells, and irritation.

Long before this time the "cancerous cachexia" has become established. The hæmorrhage, foul and profuse discharge, pelvic pain, irritability of the bladder, loathing of food, and slight sapræmic and inflammatory feverishness, bring about a change in the patient's appearance which is quite characteristic. It is marked by loss of flesh, a peculiar unwholesomeness or yellowish pallor of the whole skin, loss of colour of the lips, and even of the tongue, occasional puffiness about the eyelids, habitual want of animation, or even an expression of depression of spirits, and an indescribable air produced by want of rest and constant physical suffering. If there be an element of uræmia in the case there are superadded the special symptoms which it produces in its slighter and slowly developing forms—chiefly hebetude, drowsiness, and impairment of vision.

Owing to the increase of the cancerous mass, we may find signs of pressure upon the blood-vessels in the pelvis, just as we find pressure upon the ureters. There may be some œdema of one or both limbs. There may also be pressure on the sacral nerves, producing distressing aches or cramps in one or other of the lower extremities. Later still we may occasionally discover thrombosis, which is a comparatively rare condition, because few of the patients live to the time at which it would occur. If we find persistent local areas of œdema, local areas of pain, with change of colour about the inside of the thigh or about the groin, indicating that thrombosis or phlebitis has occurred, then we may feel assured that the patient has not long to live.

Now these conditions, symptoms, and local changes occurring in the various parts, have been described in sequence; but they develop, of course, more or less simultaneously. In this advanced state the patient, as a rule, is constantly in pain; in the back, in the groins and thighs, and in the hypogastrium. It is a question whether there is any nocturnal exacerbation of the pain in the advanced stage when there is a fixed mass in the pelvis. If such patients do not receive soothing medicines their pain impresses itself more upon them in the sleepless and silent hours of the night, but there is no proof from exact clinical observation that severe painful exacerbations occur regularly in the night or at other definite times like the maximum and minimum of the barometer.

It is not often that we meet with cases which have run their course without medical or surgical interference. Such cases, however, are on record, and illustrate the natural history of ulcerating epithelioma originating in the vaginal portion. The symptoms may attract so little attention throughout that medical advice may not be sought until the end.

Causes of death from cancer of the uterus.—Supposing we have to do with an advanced case, we must consider what facts would lead us to anticipate an early fatal termination. In what direction will the complications appear which will lead to the inevitable end? In a large number of cases there seems to be no special direction. The patient dies from marasmus, from want of nutrition of the tissues, and consequent loss of power of the whole organisation—of the muscles, heart, organs of respiration, and nervous system. Occasionally, owing to some complication, we find peritonitis spreading from the uterus to the pelvis generally, and even beyond it, causing pain and further depression of the heart's action. It may also be accompanied by diarrhœa, which precedes the fatal termination. Occasionally, in advanced cases, we find that the disease spreads to the Fallopian tubes, causing a cancerous form of pyosalpinx; just as we find in some cases that obstruction of the os internum with bacterial infection produces the cancerous form of pyometra. From the tubes the inflammatory process may spread to the ovaries and peritoneum. But general peritonitis, from some sudden giving way of protective adhesions, or bursting of an abscess of the tube or ovary arising from cancer, is of very rare occurrence.

Œdema of the lungs, heart failure, ascites, are local indications of extreme loss of strength. But the commonest of all the complications arises from the interference with the functions of the kidneys by pressure upon the ureters, though uræmic convulsions are comparatively rare. Occasionally, but very seldom, sudden hæmorrhage is the immediate cause of death.

Duration of the disease.—With this subject of the causes of death comes the question as to the duration of life in any given case of cancer. This is a question which we are always asked when the diagnosis has been finally established; and it is one which, with the evidence which is available, we can seldom answer in a manner satisfactory to ourselves. Extreme periods have been set down as the duration of cancer; but there are no two cases alike, and any application of averages, except in groups of similar cases, is entirely misleading. The patients, as a rule, are not greatly dissimilar in certain respects. By the time the first symptoms of cancer show themselves the vast majority of them are in comparatively poor health, and if they belong to the same class socially, they have gone through similar experiences of life. Speculation as to how long the disease would require to produce a fatal result is now useless, inasmuch as all cases in the early or middle stage which come under observation are submitted to more or less radical treatment. The inoperable cases are the only class concerning which we have basis of fact to draw conclusions from. Kroemer (11) gives the statistics of Pfannenstiel's "Cancer-material," and shows that the average duration of life in the inoperable cases after excochleation and the application of zinc chloride was from seven to eight months.

When we meet with a patient on whose face the cancerous cachexia is impressed, whose symptoms date back for many months, whose uterus is fixed and ulcerating, and about whom there is a haunting fœtor, however slight, we can only look for a short and downward course. We may say that the patient will live a year, but we know that a considerable portion of the time in this last stage will be really passed in intolerable suffering, only to be relieved by the judicious application of a process of euthanasia. In such cases, too, we must always look for embarrassment of the kidneys, and keep in mind that there may be a rapid or sudden termination in uræmic convulsions, or in hebetude deepening into coma which may be their equivalent.

II. Cancer of the Cervix.

After what has been already said, the consideration of cancer of t[illegible] cervix, in the narrower sense, need not detain us long, if we direct o[illegible] ntion strictly to carcinoma cervicis uteri, and not to those forms of ignant disease which are often described as such, but which are ainly, or almost certainly, cancer beginning in the circle of the os ernum. Such cases should, strictly speaking, be regarded as forms of cer of the portio vaginalis.

Cancer of the cervix, in the restricted sense thus indicated, occurs in well-marked forms. In the first of these, when it is still in a paratively early and clearly distinguishable stage, the patient tions symptoms which suggest malignant disease. There is the racteristic form of hæmorrhage, and there is a tolerably profuse and picious discharge, which may or may not have become offensive. nsiveness of the discharge depends upon bacterial infection; and the vix is protected from infection in the early stage of the disease in the e way as cancer occurring in the cavity of the body, but in a less ree. It is the proliferation of epithelium, the consequent reaction in tissues with congestion and profuse discharge from the cervical nds, and finally ulceration which brings about the characteristic thin, ious, or dirty-water serous discharge from the affected area. Most hologists, and clinicians who pay special regard to pathology, are eed that the disease originates in the deeper cells of the cervical nds; not more superficially.

As the disease advances, the destruction of tissue proceeds upwards ards the os internum, and in this class of case it sometimes invades passes beyond the internal os. At an equal rate, as a rule, it passes wnwards, chiefly destroying the mucous lining, and invading more or the parenchyma of the cervix. In the supposed example when seen ore destruction of the vaginal portion is greatly advanced, the cervix be found enlarged, but not usually to a very marked degree. The externum may be more or less patulous, probably plugged by ealthy-looking slime, mixed with turbid or sanious serum; and the t impression on inspection through the speculum is that the case is of marked erosion. There is a ring of eroded mucous membrane ending more or less widely round the external os. But in the cases which we can speak with confidence, there is something both in the our of this eroded area and in the appearance of the discharge that ggests malignancy. Only exceptionally the tissues are found hard, egular, or nodular on the first digital examination. It is the patient's pearance which, taken with the symptoms, excites suspicion. If in such ase the sound be used, it will give the impression of touching abnorlly soft and probably irregularly distributed tissues; and if, on picion being roused, a suitable sharp curette be passed through the ernal os and tried upon the cervical tissue, this will be found soft flabby, and there will be no difficulty in obtaining shreds, or rather gs, for examination. At this stage there is still no invasion of ametritic connective tissue; and, consequently, the case is in a favoure condition for total extirpation.

The second form is comparatively rare, but there are points in it of great interest from the surgeon's point of view. It may be called the sclerotic form of cervical cancer. An ordinary case, as met with in practice when the disease has sufficiently advanced to make the subject of it seek for medical relief, presents on vaginal examination a hard, irregular vaginal portion, suggesting that peculiar cartilaginous hardness which is often found towards the menopause in a woman who has suffered for many years from chronic cervical catarrh. Digital examination also usually reveals the fact that the uterus is movable, or the movements are only slightly embarrassed. The first step in physical examination probably also proves that no hæmorrhage is produced by touch, and that there is little discharge. Pain is the symptom which has led the patient to seek advice; hence, probably, the reason why such cases are seen in a comparatively early stage. The patient has usually passed the menopause, and for years has been free from symptoms referable to the pelvis.

On examination with the speculum, it is found that the external os uteri is comparatively little involved. There is probably a hard, unwholesome, and shallow excavation at some point occupying a portion of the circumference of the os. All that is visible of the rest of the uterus may appear comparatively anæmic; there is usually, in fact, merely indications of senile changes. Investigation into the condition of the cervix with the probe or sound produces only slight hæmorrhage. If for the purpose of this inspection the vaginal portion be seized with a volsella, it will be found then that the movement of the uterus downwards is much the same as in the later stage of convalescence in perimetritis. Movement is only slightly diminished. The sound may be passed through the cervical canal, which will be found narrow and irregular. In the cases in which I have succeeded in extirpating the uterus the body has been found uninvaded and senile. This variety of malignant disease of the uterus is the only one which, at the early stage, may suggest an exception to the conclusiveness of the evidence produced by the sharp curette. It requires firm pressure with the instrument to break through the surface of the hard ulcer.

The most striking characteristic of this form of malignancy from the surgical standpoint is a comparatively early invasion of the connective tissue, both laterally and between the uterus and bladder; and in the course of operation difficulty is consequently experienced in reaching the peritoneum either in front or behind.

DIAGNOSIS OF CANCER OF THE PORTIO VAGINALIS AND CERVIX

In an ordinary case of cancer of the portio or cervix, in which the disease is far advanced, the diagnosis of cancer is among the easiest of case-problems with which the practitioner has to deal. There is the history of irregular vaginal hæmorrhage, if there be nothing else. On making a vaginal examination in such a case, even when the disease is not sufficiently advanced to produce fixation of the uterus, the diagnosis can usually be settled by palpation alone. There is either a hypertrophic, hard, irregular nodular condition of the vaginal portion of the uterus, which is friable and readily bleeds under the exploring finger, or there is more or less of an excavation with hard, irregular edges. In the cases in which the disease is further advanced, there is more or less of fixation of the uterus with excavation; seldom, perhaps never, does the uterus become fixed whilst the disease is in a stage of mere hypertrophy with ulceration of the vaginal portion, or even in fairly advanced cases of cauliflower excrescence. Palpation of cauliflower excrescence settles the question of malignancy without any further question of physical exploration. In the comparatively early stage, should palpation not settle the question in the mind of the practitioner, the speculum must be brought to his aid. It is only in the cases of flat cancroid or early ulceration that any additional information essential for diagnosis can be gained by visual inspection. The ability to distinguish between the worst case of cervical catarrh produced by laceration with ectropium, and complicated with ulcerating cervical glands, and the earlier stage of possibly malignant disease, implies a familiarity with the various phases of non-malignant disease of the vaginal portion of the uterus. The malignant condition, however early, always presents an appearance of "unwholesomeness," which is not seen in the extremest form of non-malignant change. It is not possible to lay too much stress upon the need for diagnosis at this early stage of malignant disease; the life of the patient depends upon correctness of early diagnosis. It is quite true that temporising is permissible to some extent; in some exceptional cases delay may be unavoidable. In a dubious case it may be best to scarify the surface and the edges, in order to open retention cysts, and then to apply, for a few days in succession, some medicated preparation of glycerine which will not discolour, inflame, or otherwise greatly change the appearance of the suspected surface. But in this early stage, for diagnostic purposes, the great feature of malignant disease, as compared with any other condition which could possibly be mistaken for it, is the *friability* of the affected tissue. This condition I consider to be a pathognomonic indication of the presence of malignant disease in the earliest possible stage. The method of diagnosis in the presence of this great fact of friability is one which every general practitioner may apply in order to establish a *prima facie* case. This friability is indicated by the readiness with which, even in the less advanced cases, one can fill the sharp spoon by a clearly cut out portion of tissue.

If in any given case under examination the results obtained by palpation and the closest visual inspection still leave some doubt in the mind of the practitioner whether the condition be early cancer of the cervix, the doubt will, in my opinion, be invariably cleared up by ascertaining the amount of friability of the tissues. The suspected vaginal portion must be thoroughly exposed by a suitable speculum, and the uterus held steady by the volsella. Then with the sharp curette or spoon an attempt is made to scoop out some tissue from the suspected area. If the disease be malignant, a definite compact piece of tissue, larger or smaller according to the extent of the infiltration and consequent friableness of the tissue thus operated upon, will be obtained. If the disease be not malignant, a firm scrape with the sharp curette will only make the part bleed, and, at the most, some small thin shreds or a pellicle of semi-translucent epithelium, or of granulations, will be detached. The difference is very strikingly brought out by comparing the effects thus produced upon a case of old chronic cervical catarrh, marked by hypertrophy, ectropium, and retention cysts, with the effects produced by similar forcible application of the spoon to the tissues in the early stage of epithelioma. The existence of this contrast, with its easy application to diagnosis, is of the greatest importance in general practice, inasmuch as chronic cervical catarrh, complicated with the other tissue changes just mentioned, is very common, and is almost the only condition at all likely to be mistaken for early epithelioma of the cervix.

Specialists in diseases of women and pathologists usually assure the general practitioner that the diagnosis of cancer in its earlier stages is not complete without microscopic examination. Such an assertion discourages exact clinical observation, and is equivalent to telling the general practitioner that he is incapable, on account of ignorance, or disabled by the exigencies of his professional life, from forming a sufficiently exact diagnosis in a class of cases of frequent occurrence, and in which such serious practical consequences may follow his mistakes. If is, moreover, misleading, inasmuch as it attaches undue weight to the microscopic method of diagnosis, which experience proves to be undeserving of such implicit confidence. It may be stated broadly that every German, and almost every Continental gynæcologist, supports the opinion of the importance of microscopic examination in diagnosis. Von Winckel says that "it is evident from the pathology of carcinoma that in its earlier stages the disease can be recognised only by the aid of the microscope. This will reveal the characteristic atypical epithelial proliferation in the tissues, and the consequent destruction of the latter." Auvard, who is almost an exception, devotes much space to the clinical features in establishing the diagnosis; and he quotes Cornil to show that even with the microscope differential diagnosis may be impossible. "An excised portion of the tumour most frequently permits an experienced eye to arrive at an anatomo-pathological diagnosis, but, nevertheless, there are cases of malignant adenoma in which it is difficult to make out any distinction from the structure of simple adenoma."

I have no hesitation in saying that diagnosis by microscopic examination, as far as the general practitioner is concerned, into whose hands come the overwhelming majority of cases of early cancer of the uterus, is simply impossible. If you take, for example, the description by Ruge and Veit of the appearances of non-malignant papillary or glandular erosion of the cervix uteri, and their opinions with regard to the appearances of non-malignant compared with malignant changes within the same area, their statements do but add to our difficulties. They say that there is no clear border-line, so far as histology is concerned, between the benign and malignant changes; and it requires a long and concentrated experience, and the special knowledge and acquirements of a professional pathologist who has given much attention to gynæcology, to make out the difference with such clearness and confidence as to guide him to a conclusion on a question implying such serious practical consequences as whether a tissue change in the uterus be benign or malignant. When the clinical test establishes at least a very strong presumption of malignancy, any further evidence to be obtained from the histology of the scooped-out portion of tissue may be sought for according to the special circumstances of the case. But after the application of the clinical test the chief help will be found in closely watching the changes which take place in the wound, and these alone are then sufficient evidence in every case to enable us to differentiate malignant disease of the cervix from any known condition which simulates it.

When we come to consider the local conditions and appearances which may give rise to suspicion of malignant disease of the vaginal portion or cervix, the most common case for doubt is that of chronic cervical catarrh, with laceration, ectropium, and extensive "erosion." Still further, if in such a case there be also present chronic retroflexion, resulting from injury in parturition followed by subinvolution, there will be considerable added hypertrophy and other changes of the posterior lip. When the results produced by all those factors are present in the same case the nearest approach to malignant disease which we know of is reached. This is the sort of case in which doubts, which are not to be cleared up by rest, temporary medication, scarification, and similar measures, are set at rest by the use of the sharp curette.

The next class of case in order of the frequency with which doubts arise and mistakes are made is that of necrosis of fibroid polypus with partial expulsion from the external os. Such cases are occasionally sent to the specialist for diagnosis, and I have seen a considerable number of them. The ring of the external os is the diagnostic feature; the ring of the uterine tissue is found to be intact, homogeneous, and smooth. Cases of this class should seldom present more than a momentary difficulty. In all the cases which I have seen it has always been the repulsive appearance of the sloughing mass that has led to the erroneous diagnosis. An inexact clinical history in which symptoms are accepted as occurring in the order in which the patient mentions them, a perfunctory examination of the parts that can be brought into view, and want of attention to differences in the appearance and smell of the discharge, which certainly does not invite close investigation, are sufficient to keep up the supply of cases in which such mistakes in diagnosis are made.

In some cases the question may arise: Is the disease malignant or specific? Much library writing has been devoted to the differentiation in such cases between cancer and syphilis. My experience of English practice leads me to the conclusion that syphilitic ulceration of the vaginal portion of the uterus is among the rarest of the diseases of women. I have several times in the earlier years of special work suspected syphilis, and temporised accordingly, in order to see the effects of general and local antisyphilitic treatment; but in not one single case has the ulceration turned out to be other than malignant. There can be no doubt, however, that a real difficulty might arise owing to the extent of ulceration sometimes produced by syphilis in elderly subjects with constitution ruined by ill-usage or by the sins and faults of youth. The difficulty may be increased by the fact that a history of syphilis is to be found in cases of well-marked and unmistakable epithelioma, with a frequency not to be accounted for by mere coincidence. Von Winckel says the difficulty is so great in some cases that experienced specialists in venereal diseases have sent patients to him for his opinion. Obviously under such circumstances there is no simple, infallible, and universally applicable rule. The syphilitic lesions, early and late, do not necessarily involve the os externum; malignant disease always does. The syphilitic lesion has little tendency to bleed, and is not friable; the malignant lesion differs from it in both these respects.

Some Continental writers make much of the difference between papillary malignant disease of the cervix and "pointed condyloma." No advantage can result from the accumulation of distinctions and differences of such small account from the practical standpoint. I doubt if any man ever saw a case of condyloma affecting the cervix uteri, for example, in a pregnant woman, in which condyloma were not also obvious in the vagina, on the vulva, perineum, or even in the groins. Careful separation of the elements of a papillary condylomatous mass or tuft, and the inspection of the relations of these elements to one another, to the common portion at the base, and the relation of that base to the intact underlying cutaneous or mucous surface, must set the mind at rest. The practitioner will note, moreover, the results of keeping the parts clean with an astringent antiseptic, the effect of snipping away some of the tufts, of the application of nitric acid to a selected spot, and of a simple microscopic examination.

Considerable attention has been paid in recent years to genital tuberculosis, and efforts have been made to distinguish clinically between epithelioma and tuberculous disease of the portio vaginalis. All are agreed that the frequency of occurrence of genital tuberculosis is much greater than was formerly supposed, but primary tuberculosis is rare, and if it reaches the uterus by descending, disease of the vaginal portion and cervix must be the rarest form of all. It has been described as a polypoid proliferation of the mucosa of the portio, the differential diagnosis being established by histological and bacteriological investigation. Horrocks, Croft, and Lewers have described cases simulating cancer of the cervix, and apparently not to be differentiated clinically from it (*vide* p. 261). Glockner has described a case of primary tuberculosis of the portio vaginalis. Sellheim thinks that clinical diagnosis is practicable, and he enumerates the points on which he would depend; all other writers agree that clinical diagnosis is seldom made, differentiation by examination after operation being the almost invariable rule. Beyea describes three different forms of tuberculous disease of the cervix—the ulcerative, the hyperplastic, and the miliary.

Just as we find cases in which carcinoma and sarcoma are associated in the same uterus, so we find occasionally carcinoma and tuberculosis in the same uterus. Wallart describes one case of carcinoma and tuberculosis of the cervix in which exact observations were made. Differential diagnosis or exact diagnosis in such a case is obviously impossible.

The weight of opinion is in favour of radical operation in every case of tuberculosis of the cervix uteri when the condition of the uterus is apparently the only lesion, so the establishment of the exact nature of the disease has comparatively little clinical interest.

Cases have occurred in which partial retention of products of conception have led to some difficulty in settling the question of malignancy. A shred of placenta, or a plug of decidual tissue sticking in the os externum, has been supposed to be cancer, and conversely. There may be ugly débris, some hæmorrhage, or sanious and evil-smelling discharge in careless, apathetic women. But the chief aid to differential diagnosis in such a case is a clear detailed clinical history; when such a history is obtained the diagnosis can hardly fail to be complete.

Prognosis.—The prognosis in cases of cancer of the vaginal portion or cervix cannot now be laid down on the old considerations of the causes of death in such cases and the probable duration of life while these causes are doing their work without interference. Prognosis now depends upon what can be done; and what is practicable and beneficial, and what is impracticable and harmful, depends upon the stage of development which the disease has reached, and to some extent upon the special area affected.

We first think of operation. If vaginal hysterectomy is feasible, we estimate the risk to life from the operation and the possible permanent or temporary immunity from recurrence. These are questions which can be best dealt with under the head of Results of Operation. We have only, therefore, to consider the inoperable cases. We know that here a fatal termination is inevitable, and we must consider whether there are any measures which may appreciably retard the progress of the disease and diminish the sufferings of the patient. By this time the uterus is fixed, or there is such obvious lymphatic infection that extirpation would be useless, even if practicable. We must then consider mainly the following points all brought out under symptoms and clinical course:—(1) Is the disease of long standing according to the data obtainable? If the symptoms can be traced back to a longer than average time, then the progress of the disease is slow; if it is of comparatively recent date, the course is rapid, and the prognosis bad in proportion. (2) Is the cancerous cachexia established? If so, then some complication may occur at any time, hæmorrhage, septicæmia, thrombosis, or some other grave condition with its dangers. (3) Are there any indications of embarrassment of the kidneys? If so, an opinion as to the probable length of life of the patient cannot be too guarded. We have no means of ascertaining the exact extent of the changes which are bringing on uræmia. (4) The age of the patient has usually some relation to the rate of growth; the younger the patient the worse the prognosis. To this rule, however, the exceptions are numerous. (5) Does the patient take nourishment to the average amount in such cases? It is obvious that if no specially threatening complication exists, the fatal end from inanition must be hastened or delayed according to the patient's power of assimilating food. (6) Can the parts be kept in a tolerably aseptic condition? If there be a cavity in the cervix, and if the body of the uterus and the vagina be not involved, the ulceration, and consequently the sapræmia, can be modified. In some cases, owing to descending growths in the vagina, the chief seat of the disease cannot be reached. The success of some of the palliative methods of treatment shows that the progress of the disease can be considerably modified by the use of the curette or cautery and deodorising antiseptics.

TREATMENT OF CANCER OF THE PORTIO VAGINALIS AND CERVIX UTERI

When a disease of the uterus is diagnosed as malignant the question at once arises, Is it operable or inoperable? If in a case of cancer of the portio or cervix the uterus is quite movable, and if on examination it is found that no considerable invasion of the broad ligaments or sacro-uterine folds has occurred, then the treatment in our present state of knowledge is radical operation. If there is lymphatic infection, and considerable or complete fixation of the uterus, the case belongs to the inoperable class. Even when the uterus itself is in a condition to make operation otherwise feasible there may be some local complication or some general condition rendering the radical operation unjustifiable. In all operable cases the first question to be answered is whether total extirpation per vaginam be not the best method of treatment.

Total Extirpation of the Uterus.—The operation may be undertaken at one or other of two stages in the development of the disease. In the first place, the object sought is the entire ablation of the affected organ, including surrounding portions of vagina and parametrium which show no trace of invasion by the disease. The tissue operated upon must be sound throughout. Such are the cases in which, when the operation is performed at a very early stage, and the patient survives the danger of the surgical procedure and all the other prognostic details are favourable, there is ground for a fairly confident hope that the patient is permanently relieved of her troubles.

In the second place, the operation may be undertaken with advantage even if there be some slight interference with the movements of the uterus, and the broad ligaments or sacro-uterine folds can be felt to be more prominent and better defined than in perfect health. In such cases there is some additional difficulty in the early stages of the operation; but the remote results are so satisfactory as not only to justify but to demand operative treatment. There is little ground for expecting a permanent cure in such cases. The disease will recur at a more or less remote date, but the immediate advantages, mental and physical, to the patient, and the diminution in the sufferings of the late stage of the disease, when recurrence has taken place, are such as greatly to outweigh the danger and distress of operation. These are usually cases in which, owing to delay on the patient's part in seeking medical advice, or owing to want of promptness and precision in diagnosis on the part of the practitioner, the disease has been allowed to make considerable progress. The vaginal portion may have assumed the condition of a large hypertrophic and superficially ulcerating mass; or it may have almost completely disappeared owing to the progress of ulceration within the cervical canal, and yet the uterus may not be completely fixed. There may be obvious indications of deterioration in the patient's general health owing to hæmorrhage and other discharges and the inability to take sufficient nourishment. The sanious or turbid serous discharge may have become so profuse and offensive as to be a source of distress to the patient; but while the pain is still inconsiderable, and the movements of the uterus are but just appreciably embarrassed, there is every reason to expect a favourable result from radical surgical treatment by the vaginal route.

Results of Total Extirpation per Vaginam.—The details of surgical proceedings do not concern us for the present.

The statistics of the immediate results of total extirpation of the uterus per vaginam have long ceased to be of interest from the standpoint of the apologist for the operation. It is established as a comparatively safe operation, not only justified but demanded under certain conditions. The alternative operation is now very seldom partial removal of the uterus per vaginam, but total extirpation by the abdominal method. And the comparison between the operations is made not so much on account of the immediate result of the surgical measures adopted, as to ascertain which operation produces the largest percentage of permanent cures.

Eight years ago I found that the immediate mortality over a very large number of cases of vaginal extirpation reported from Europe and America was a little over 5 per cent. According to the method of counting adopted by myself the results of about 300 operations of my own showed a mortality of nearly 10 per cent. So recently as June 1904, Besson, of Lille, published results of his operations, extending over ten or twelve years, showing a mortality of 15 per cent. These discrepancies seem to point to a comparison of unlike things, or to some conventional way of reckoning mortality analogous to that which is generally accepted in calculating the percentage of permanent cures. The constant efforts to extend the limits of "operability" so as to bring in a large proportion of cases as fit for operation must be a disturbing factor in the calculation of results both immediate and remote, but the result would be a tendency to a higher, not to a lower immediate mortality. Winter (33), according to his method of reckoning the immediate mortality of vaginal extirpation for cancer of the cervix or portio vaginalis, found the operation more fatal in cancer than when the reason for operating was the presence of a benign growth or any other abnormality. In about 1000 cases of cancer the mortality was 7·1 per cent; in 250 other cases of extirpation the mortality was 3 per cent.

Para-Vaginal Section (Schuchardt's Operation).—After the failure of the sacral method and other modifications attempted by various operators to secure greater immediate safety and better permanent results, or to extend the field of operability, Schuchardt (26) introduced a modification of the vaginal method which he called para-vaginal. It was brought forward as an alternative to the formidable and dangerous abdominal method of extirpating the cancerous uterus. Schuchardt's operation certainly looks very formidable, but my experience of it would lead me to the conclusion that in suitable cases it should be the safest and easiest and most effective of all the operations. The best results obtained by vaginal operations before Schuchardt's were those of Leopold, of Dresden, who with an operability of 20·4 per cent could count 50 per cent of his cases as "cures" by the conventional method of reckoning, and 10·2 per cent of absolute cures or permanent non-recurrence. Schuchardt raised the operability to 61 per cent, and had conventional cures to the extent of 40 per cent with 24·5 per cent of absolute cures. In a group of 9 easy cases he had the astonishing result of 8 cures, that is 88·9 per cent, as all recovered from the operation and the disease recurred in only one case.

Abdominal Operations.—At the present time, and for the last six or seven years, there has been noticeable, especially in Germany and America, a certain emulation among gynæcologists in the extension and completeness of abdominal hysterectomy for cancer. The discussion on the merits of various operations shows no sign of leading to anything like consensus of opinion and uniformity of practice. The questions to be answered appear to be mainly three:—(1) In cancer of the uterus in the operable stage is lymphatic invasion common? (2) by the abdominal operation can the infected lymphatics be extirpated? (3) does the abdominal radical operation give better permanent results than the vaginal method?

First in order historically among the abdominal operations is that of Freund. It was a pioneer exploit. After all radical operations had been abandoned for about forty years Freund performed, in 1878, the first successful operation, and with it his name is associated. It was soon discovered to be a very dangerous operation, and many modifications, all equally fatal, were introduced. The danger arose chiefly from the shock owing to long exposure, and manipulation of the intestines and obstruction from paresis, peritonitis, infection with cancerous elements, nd injuries to the uterus and bladder. After another pause in operative nterprise, during which a certain depression overcame professional pinion, resulting from the recognition of the unfavourable remote esults of vaginal hysterectomy, there has been a rush of surgical proeedings, especially in Germany, to the extreme verge of the practical or eyond it, in dissecting out not only the internal sexual organs but the vhole of the lymphatics and cellular tissue of the pelvis. This has een declared to be justified by the belief that better remote results vould be obtained than by vaginal hysterectomy.

From a careful and laborious attempt to keep up with the record of roceedings, I have no hesitation in saying that a large portion of the xtended radical abdominal hysterectomies for cancer are not justified by nything hitherto advanced in their support. Most of the cases recorded ave been too far advanced for any operation, however radical. "The adical nature of these operations," says one German critic, "is expressed nly in the sad immediate and remote results, a high primary mortality nd injuries to the ureters and bladder in those who survive for a time." The operators profess to dissect out the lymphatic glands, pelvic, iliac, ypogastric, sacral, inguinal, lumbar; and they resect the ureters and eimplant them in the bladder when they interfere with the scope of the roceedings. The immediate mortality is terrific. And so far as xperience of the remoter results has ripened into guiding our inferences, ll admit that the patients who escape with their lives from the operaions, occasionally reckoning only the possession of a permanent urinary istula or the loss of a kidney among the consequences, are no better off n relation to recurrence than those who have undergone the comparaively safe operation of radical vaginal extirpation.

Among the most recent partisans of the advanced abdominal operation is Döderlein (4). By the vaginal operation he had a primary mortality of 16·4 per cent, but satisfactory permanent results in the survivors. He also holds the opinion that in cases of cancer of the body better results are not obtained by abdominal than by vaginal operation. Since the beginning of 1902 he has followed the method of Wertheim, with modifications. In less than 23 per cent he found enlargement of lymphatics in the pelvis resulting from carcinomatous infection. The glands were infected in corpus carcinoma in only 9 per cent, and these were very advanced cases. As to technique Döderlein deprecates extensive dissection of the connective tissue in searching for glands, and he avoids, as far as possible, interference with the ureters. On the other hand, he advocates the adoption of Pfannenstiel's "transverse incision," that is, an incision from one anterior superior spine to the other, on the ground that it gives better access to the field of operation.

The modifications of Wertheim's operation are about as numerous as the operators who have published their results. Wertheim has given a report of the results of six years' endeavours to extend the extirpation of the cancerous uterus (32). Of fourteen cases, indicating an "operability" of 29·2 per cent, nine were free from recurrence after four years. The more recent cases are of comparatively little interest. Wertheim does not state the primary mortality. Since the report of results given at the Congress at Rome in 1902 recurrence has taken place "in nearly all the cases of extirpation in which the lymphatic glands were found to be cancerous," and it begins to appear very doubtful whether dissection out of the glands diminishes the frequency of recurrence after abdominal extirpation. Wertheim admits that is quite impossible to sweep away all the regional lymphatics, and that the extirpation of the enlarged glands only has not led to the favourable results expected.

Partial Extirpation.—High amputation of the cervix was the first great step in the evolution of the surgery of cancer of the uterus. In the hands of Schroeder and some of his pupils, such as Winter and Hofmeier in Germany, some excellent results were obtained by this operation, but there is no denying that it has become almost entirely obsolete. The tendency is all in the direction of more extensive operations, such as para-vaginal section, when the vagina is very narrow, or the uterus unusually large, or some of the varieties of abdominal hysterectomy. Among the last supporters of the partial operation in this country was Lewers (15), but he had almost abandoned the method two years ago, "in spite of the good results" which he had obtained from it. With a general consensus of opinion against the partial operation, it cannot serve any practical object to give in detail the reasons assigned by operators for abandoning it in favour of other methods. It seems to me that there is only one clearly defined class of cancer of the portio vaginalis in which the partial may be the best operation, that is, in old or elderly women, in whom the disease is very slowly developing while the uterus is perfectly movable, and the vagina is narrow and senile. Such cases are, however, as a rule, best treated by para-vaginal section.

Excochleation, or Byrne's Operation. — Among the partial operations which may be mentioned is that of Byrne. He has received much commendation in America, but little or no imitation. The operation may be described in one word, excochleation. It is said to have next to no immediate mortality, and extremely favourable permanent results. Unfortunately, according to Byrne's own account of the remoter results, about one-third of his patients had "strayed away," or "been lost sight of." He mentions, however, one patient who was in "perfect health" over twenty-one years after operation. The operation has either inherent defects which critics have not the courage to indicate, or it has had to give way before the trend of opinion in favour of extensive operations.

Palliative Operations.—When the cancer is too far advanced for any radical operation the question always arises whether any benefit at all can be conferred by local treatment. The patient has reached the stage at which symptoms have to be treated as they appear, but such treatment is dreary and unsatisfactory work, and every available means should be brought into use which offer any reasonable ground for the expectation of benefit. In a considerable proportion of the advanced cases there is a deep ulcerating cavity which may contain spongy débris, the result of the necrosis of the uterine tissues. In such cases there is a foul and copious discharge, with intermittent attacks of hæmorrhage. These are the cases in which the sapræmic process at work is also doing the most harm in sapping the patient's strength. What means of local treatment worth employing has the medical practitioner at his disposal?

The sharp curette is naturally placed first; whether it be used alone, or supplemented by some chemical agent to destroy the infected tissues further. In such patients we cannot use the curette efficiently without the aid of an anæsthetic. Yet when there are grave objections to the administration of chloroform or ether, the operation may still be carried out more or less completely without inflicting much pain. In such cases I have found it of great advantage, about an hour before the time appointed for operating, to give a considerable hypodermic injection of morphia; and just a few minutes before beginning, a fair dose of whisky or brandy well diluted. When these medicines have taken effect it is wonderful how well the patient can bear even a tolerably thorough use of the instrument.

In an ordinary case, when the patient has been put under the anæsthetic, it is best to place her on a table in a good light, and proceed with all the care as to detail and circumstance of an important operation. The patient is placed in the lithotomy position, and the parts are thoroughly brought to view with the aid of the weighted speculum. The uterus and vagina are thoroughly swabbed with a solution of mercury, which helps to deodorise as well, and the uterus is, if necessary, steadied with a volsella. The broken-down tissue is then rapidly swept away, and every portion of the cavity is carefully gone over in detail until the instrument is felt to rasp upon firm substance. It is occasionally necessary to employ scissors to cut away tags of comparatively healthy material, chiefly at the margins of the ulcer. The cavity is frequently swabbed with cotton-wool soaked in mercury solution. Such an operation has its uses in stopping hæmorrhage and foul discharge for a time, but only comparatively slight and evanescent effects are to be expected from it.

If it be worth while using the curette, its action should be supplemented by an escharotic; and of all the substances available at present there can be little question that zinc chloride is the best. It should be put ready beforehand to apply immediately after the curetting, and it should be in the strongest manageable form. It is a good plan to finish by packing the vagina with a tampon consisting of a long strip of lint soaked in a strong solution of soda. This tampon may be left for a day, or even for two days; it is then removed, and an antiseptic douche copiously used.

RECURRENCE AFTER OPERATION

Under the head of the course and symptoms of cancer of the vaginal portion and cervix we may best consider the modes of recurrence after operation. In by far the greater number of operation cases it is the cervix, or part of it, which is affected; and it is after operation for malignant disease of the cervix that recurrence takes place in the vast majority of cases. We divide the cases into three classes: (*a*) Recurrence by metastasis; (*b*) lymphatic recurrence; and (*c*) local recurrence, that is, at the site of the wound.

With regard to *metastasis*, all observers are agreed that it is not common as a result of uterine cancer. Gusserow summarised the opinions which prevailed before total extirpation of the uterus. Metastasis, according to Blau and others, occurred in the liver in 9 per cent, in the lungs in 7 per cent, and in the kidneys in 3·5 per cent of cases which ran their course. In women who have undergone the operation of total extirpation, metastases are almost unknown. In 43 cases of recurrence after operation, in which he made a post-mortem examination, Winter did not find a single case with metastasis. In 202 cases of recurrence only 9 were real examples of metastasis. Only 2·5 per cent of all women operated upon suffered from metastasis, which occurred in the stomach, lungs, liver, and ovaries.

Lymphatic recurrence is of more importance. The glands which become affected from cancer of the cervix are the iliac; these lie close to the sacro-iliac synchondrosis, just below the brim of the true pelvis, and at the point of division of the iliac and hypogastric arteries. From cancer of the body the lumbar glands are affected. These may develop into masses in which the aorta is embedded, and they may be felt high up in the abdomen. Occasionally, by anastomosis, the obturator, and inguinal glands become affected. Infection of the pelvic glands is not so common as we might expect, and it occurs comparatively late. In operable cases in clinical examination Winter found the glands infected three times; when the parametrium was involved, the glands were found to be infected in 24 per cent of the cases. Pure lymphatic recurrence is rare; it is in conjunction with recurrence in the cicatrix that the glands are found most frequently affected.

Local recurrence is by far the most frequent form. It occurs in the cicatrix, in the bladder, peritoneum, pelvic cellular tissue, and vagina. The most common cause of this relapse is without doubt the incomplete removal of the affected tissue at the operation. This recurrence is then early, as a rule. All observers agree that one chief cause of recurrence is permitting cancerous material to come in contact with the peritoneum or freshly wounded tissues. The disease is then an inoculation recurrence, and this infection appears to take place only on account of that special state of health of the patient which made the original disease possible. The recurrence in the vagina has some points of interest of its own; it must be a fresh development of the disease produced by prolonged contact of the cancerous growth with a surface not specially susceptible. Many such cases have been reported, and they go to prove the infectiousness of cancer by prolonged contact in suitable subjects.

The study of recurrence leads at every point to important practical conclusions, especially with regard to the need for extreme care to prevent infection at the time of operation.

The Cautery.—The use of the cautery is one of the best methods of dealing with inoperable cases of cancer of the uterus. It appears to be a special favourite in German *Kliniks.* One of the difficulties we have to meet in the efficient use of the cautery is to find a suitable instrument. The ordinary cautery, prepared to white heat, and then applied when it is getting dull, is theoretically one of the best; but, unfortunately, in practice it invariably gets cooled down too rapidly, and it is necessary to wait, with the patient under the anæsthetic, until the instrument is again heated, or to keep a series of the instruments hot and use them at intervals. The same objection applies very largely to Paquelin's cautery. It is applied apparently in perfect order, but it is liable to be cooled down by the blood, and time is lost in again re-heating it; at least such is my experience of the use of the cautery in this operation.

One of the most effective forms of cautery is the galvanic, which consists of a suitable stem for application, with means for turning on and interrupting the current. This cautery, as a rule, works well, but I have repeatedly found that if we attempt to increase the strength of the current as the button cools down the platinum wire gives way, and the operation suddenly collapses. All the objections, also, which may be reasonably brought against the use of the curette are yet more applicable to the use of the cautery. Among the chief advocates of this method of palliative treatment we must count Fritsch, who trusts to it as the means of destroying the infiltrated tissue, and of bringing about similar results to those obtained by the efficient use of chloride of zinc.

Interstitial Injections by the Hypodermic Syringe.—Experiments with antiseptics injected into the tissues of the uterus were the outcome of partial failure with the curette and cautery and the superficial application of escharotics. The object more or less vaguely aimed at was the destruction of the bacterial element in the process of cancerous invasion, and so to stop or retard the progress of the disease. Neuralgic cicatrices appear to have been the best results obtained. As far as I know, the method has been abandoned as painful and useless.

Suppression of Hæmorrhage and Diminution of the Foul Discharge.—As the disease advances these objects become among the chief concerns of the medical attendant, apart altogether from operative treatment. The one rapidly saps the patient's strength and brings on anæmia; the other poisons her, and makes her an object of distress or disgust to herself and those about her. Owing to the irritable condition of the patient's digestive organs and lower alimentary canal, it is necessary to make the most of local measures. One great difficulty in the treatment is the anorexia, and we cannot afford to upset such digestion as there may be by styptic and antiseptic remedies—such as mineral acids, tannin, ergotin, or any of the turpentine series—administered by the mouth. For the arrest of hæmorrhage we must trust to pressure by a tampon introduced into the vagina, and planted firmly upon the bleeding ulcer-surface. It is usual to supplement the hæmostatic effects of the pressure by means of a styptic. The great objection to the use of the salts of iron for this purpose is the embarrassing discoloration produced by them. Each of the other known styptics has had its advocates. An endeavour has usually been made to find an agent with deodorising properties in addition to the hæmostatic. The objection to terebene and turpentine, combined with oils or in any other way, is that they produce a certain amount of pain internally, and irritation about the external genitals. A weak solution of chloride of zinc, with or without the addition of idoform, makes a useful material for application, and among those which I have tried I know nothing better than a solution of acetate of lead in glycerine, with a small proportion of carbolic acid and morphia added.

When the disease is far advanced beyond the stage of active hæmorrhage it is the foul discharge and the pain which we have chiefly to consider in our treatment. The discharge, moreover, frequently produces vulvitis and dermatitis inside the thighs and the groins. We must trust largely to internal sedatives to relieve the distress, but the smell and irritating character of the discharge may be modified by local means —chiefly by the use of the syringe charged with a solution of mercury or carbolic acid. An alkaline solution may be occasionally advantageous for cleansing and soothing, but the great majority of the chemical substances appear to serve no useful purpose whatever. Copious use of warm water or weak salt and water is quite as useful. The whole object of this phase of the treatment is to keep the affected parts as little septic as possible, and to prevent or relieve discomfort.

Relief of Pain.—When the stage of the disease is reached at which pain becomes constant it is necessary to begin the administration of sedative drugs, and this part of the treatment may be almost entirely summed up in the administration of morphia in some convenient form; no other drug is to be compared with it in its beneficial effects. Its action may have to be supplemented in some cases by sedatives which have more of a soporific action, but it may be said with entire confidence that there is no substitute for it. In operable cases of cancer there can be no reasonable ground for hesitating to give whatsoever doses may be necessary to afford relief from suffering. In some comparatively rare complications, such as pyometra and hæmatometra or concurrent disease of the Fallopian tubes producing spasm, considerable temporary relief may be given by the administration of antipyrin or the extract of viburnum; but the depressing by-effects of these drugs must be kept constantly in mind. In the distress about the anus and vulva from pressure in the comparatively late stages the action of the morphia may be usefully supplemented by the use of an ointment of lanolin containing cocaine, morphia, and tannin. When symptoms of renal complications come on it is still necessary to continue the use of morphia, while other measures are taken on the general principle of giving relief in kidney disease. It is not, as a rule, possible, even if it were advisable, to put the patient on any regimen dictated by some supposed advantages in the method of diet. The dietary should be as generous and varied as possible; the main difficulty in dealing with the patient is not to select the food but to get her to take any. The object to be kept in view is obviously to assist and maintain the nutrition as long as possible, and prevent the inroads made upon the strength by hæmorrhage, sapræmia, and pain. With this object the usually recognised adjuvants to digestion, such as pepsine, peptonised foods, and the like, should be pressed upon the patient.

With regard to the effects of the administration of drugs, throughout the whole course of the case, for purposes other than the relief of pain, our knowledge is almost nothing. We know that alcohol in suitable doses produces a certain amount of stimulation and a sense of well-being, and, if it can be well borne and duly eliminated from the system, there does not seem to be any sufficient reason for denying some reasonable amount to those to whom it would be a comfort. It may be considered, in fact, as an auxiliary to morphia and soporific drugs; and in the latest stages one of the means of euthanasia.

Arsenic has so long had a reputation in the treatment of cancer, whether internally or by topical application, that we are disposed to administer it rather lest we should be depriving the patient of an advantage than from any firm faith in its usefulness. If it can be borne, the combination of arsenic and iron, either as a pilule of arseniate of iron, or as a natural arsenical water, is possibly beneficial. I have been in the habit of recommending the constant use of arseniate of iron to patients after total hysterectomy, and my impression is that a certain amount of advantage has been obtained from it.

Quinine is recommended as a means of diminishing, as far as possible, the effects of absorption from the septic area; but it is not well borne by the stomach of a cancer patient, and in fact it is only in the comparatively early stage that it can be, as a rule, administered with advantage.

The specific treatment by Chian turpentine need only be mentioned in passing as one of the numerous empiric methods of treatment which excited hopes for a time, among persons to whom a disease is an entity, only to be abandoned like its forerunners in favour. It may have its use in arresting hæmorrhage.

Treatment by electricity, X-rays, and serum has led to no satisfactory results hitherto (*vide* p. 809). A fairly typical case is given in detail by Cleaves in *American Gynæcology* for November 1902. He employed Röntgen rays, and obtained some improvement in an inoperable case. In the same journal G. G. Hopkins has an article on "The Combined Use of the Finsen Light and Röntgen Rays in Uterine Cancer."

A pure cultivation of a parasite which Otto Schmidt (24) discovered to be the cause of carcinoma was injected into a patient, and was declared to have produced some benefit. After the injection the patient's temperature rose and the lymphatic glands of the region became swollen and painful.

Efforts are constantly being made in this country and abroad to find a serum cure for cancer. Although carcinoma of the uterus does not seem to belong to the type of disease which should be curable by a serum process, still we may all sympathise with the aspirations of those who have faith in the method, and wish them some measure of success.

It would be trifling with a grave subject even to mention some conjectures of causation and consequent methods of treatment of cancer which see the light periodically. There is a sad interest in watching the vicissitudes which occur in the history of unfounded hypotheses.

CARCINOMA AS COMPLICATION OF PREGNANCY

Malignant disease of the cervix as a complication of pregnancy and labour is a subject of great scientific interest and practical importance. Because, however, of the comparative infrequency of its occurrence, the great variations in the clinical facts of the cases, and the intermixing of ethical considerations of greater or less importance, it is impossible to make a satisfactory classification of the cases, or to lay down any rules of universal application.

When the disease is not far advanced, and it is obvious that the uterus could be extirpated without unusual danger or difficulty, the following questions naturally arise with regard to the interruption of pregnancy: If the pregnancy is not far advanced, are we to wait to the full, or nearly to the full term, and permit the cancer to grow rapidly, as it is certain to do in the meantime? or are we to interrupt labour without any consideration for the life of the fœtus in utero? With regard to the interruption of pregnancy, which is not effected at the same time as the final operation on account of the cancer, we must keep in mind the great danger of septic infection during the puerperium owing to the manipulations of the malignant new growth and its continued presence. But there is a stronger argument against giving too much heed to the child in the adoption of any modern method of obstetric treatment. If we compare the results, so far as the child's life is concerned, of the earlier practice in cases of cancerous complications with those obtained since operation has been more largely resorted to, we find that in Cohnstein's statistics, published in 1873, only 42 children survived in 116, that is, 36·2 per cent. In the 142 cases quoted by Theilhaber in giving the statistics for twenty years up to 1893, the proportion surviving was 46·4 per cent.

Now a large number of these survivors of birth die within the first few weeks; experience therefore shows that in any event the danger to the child on the expectant plan of treatment is very great. If we may infer the opinions from the practice of those who have published cases one would be led to the conclusion that the life of the fœtus has not been a matter of much concern to most of them, and that operations have bee undertaken almost entirely in the interests of the mother. Even th great exception to this rule appears to show that the mother's life an welfare should be our main consideration in deciding the time and method of operation. The great exception is the case in which the disease has not been discovered until towards full term, or when labour has begun. The case has then usually become inoperable as a case of cancer; and the only thing that can be done is to endeavour to save the child by the Cæsarean section, which may also enable the mother to live as long as the disease will permit.

The most recent important contribution in this subject is that of Glöckner (50). He gives in detail the results of many operations on the gravid and puerperal uterus. In the great majority of the cases recurrence appeared early, but there was a fair proportion of permanent cures. In 25 per cent the disease had not recurred within five years. One patient died more than ten years, and another over nine years, from the time of operation. A point of much interest in Glöckner's contribution is a comparison between German and French practice. Among German obstetricians there is practical unanimity in favour of operation without regard to the life of the child; the prevailing opinion in France is that the pregnant woman with cancer of the uterus is doomed, and the practice consequently is to wait till the end of pregnancy and to sacrifice the mother in favour of the child. The results stated by Glöckner appear to strongly support the German practice.

The operable cases of cancer of the pregnant uterus readily divide themselves into three largely comprehensive classes. Yet some operable and many inoperable cases can hardly be classified, and a study of the individual case must guide us as to what should be done or left undone. The first class includes all the cases in which the cancer is discovered before the uterus has become so large as to make removal of it, unopened, impossible per vaginam; that is to say, at the latest, in the fourth month. To the second class belong those cases in which the pregnancy is too far advanced for this comparatively simple proceeding; in these cases, in order to remove the uterus per vaginam, it is necessary first of all to empty it by bringing on premature labour while the child is still non-viable. The third class consists of those cases in which the disease is not discovered until the woman is in labour and the child is living; then the alternatives are ordinary obstetric management and the Cæsarean section with complete removal of the uterus.

Cases of the first class present the most favourable features. The malignancy may be developing rapidly, and the amount of hæmorrhage and offensive discharge may be very considerable; but owing to the evolution of the uterus the tissues are remarkably loose, and the process of enucleation thus becomes comparatively easy and safe. It is, in fact, the most favourable method of treatment if the condition be discovered in time.

When the uterus is too large for vaginal hysterectomy pure and simple, it is necessary first to bring on abortion or to perform the abdominal operation. But the dangers attaching to Freund's combined abdominal and vaginal hysterectomy are too formidable to allow it to be entertained except under unusual circumstances. To empty the uterus adds appreciable risk to the operative proceedings, inasmuch as there is considerable danger of infection. It may be assumed, however, that no one likely to undertake the management of such a case would operate without every possible precaution; or if septic metritis occurred in spite of such precautions, would allow it to run its fatal course without extirpation. If, after the exercise of every care to prevent septic infection following the induction of labour complicated with foul ulcerating cancer, and in spite of all antiseptic precautions, suspicious symptoms arise, there should be no hesitation in proceeding at once to the complete operation of vaginal hysterectomy. If no untoward symptoms arise in such a case the uterus is extirpated at some convenient time during the puerperium.

In the third class referred to, when the disease is discovered at or about full term, it is usually far advanced; and, whatever the treatment, the results are unsatisfactory. If the os uteri be dilatable, the obstetric method of waiting until the forceps can be applied appears to give the best results for mother and child. In eight cases quoted the mothers all survived and six of the children were born alive. In five cases where turning was resorted to, three mothers died.

Cæsarean section by any of the methods, or combined with Freund's total extirpation operation, has given disappointing results. Eight cases of the old method of Cæsarean section are quoted; all the mothers died. After Sänger's Cæsarean operation, of thirteen women only three survived for a month or six weeks; most died directly after the operation. Five out of twelve lived after Porro's operation; and two out of six survived Freund's combined method of total extirpation.

Three cases of Cæsarean section because of inoperable cancer are mentioned by Glöckner. All the patients died of purulent peritonitis within ten days.

III. Cancer of the Body of the Uterus

Cancer of the body of the uterus is a comparatively rare disease, but published accounts of individual cases do not now indicate that it is so rare an occurrence as was formerly supposed. More exact and earlier observation, and the inclusion of diffuse sarcoma and malignant adenoma as, clinically speaking, cancer of the body of the uterus, greatly increase the number of cases. In the statistics of large hospitals—Leipzig for example—the proportion is stated at as high as 9 per cent.

The disease under consideration is malignant, and histologically it is carcinoma; but in its clinical features, including its amenability to radical and final surgical treatment, it might almost be considered a different disease from cancer of the vaginal portion and cervix. This difference is all the more striking clinically if we compare primary cancer of the body which is the only disease under consideration at present, with cancer as found in the body when it is secondary to cancer of the cervix, whether by continuous extension or by inoculation during the manipulations of treatment, which certainly sometimes occurs. The clinical course of secondary cancer of the body is not separable from the course of the primary disease from which it sprang. We shall here concern ourselves with primary cancer only.

At the time of writing his monograph, about eighteen years ago, Gusserow had collected from all sources only 122 cases of primary cancer of the body of the uterus, including an indefinite number of cases of sarcoma. Schroeder diagnosed 28 cases as primary cancer of the body in 812 cases of carcinoma of the uterus; that is, 3·4 per cent. Carcinoma of the body may be set down as about 5 per cent of all cases of cancer of the uterus.

Pathological Anatomy.—Excluding adenoma malignum and diffuse sarcoma of the body, genuine carcinoma corporis uteri occurs in two fairly well-defined forms, according as it originates (*a*) in the parenchyma or substance of the uterus, or (*b*) in one or other of the constituent elements of the mucosa. The form originating comparatively deep in the tissues is described as developing nodules or spheroidal masses in the uterine tissue; these sometimes bulge on the peritoneal surface, sometimes on the mucous surface of the uterine cavity; but they have little tendency to soften within the uterine wall, or to ulcerate on either peritoneal or mucous surface. This form is almost invariably described by writers on the malignant diseases of the uterus, but it must be a rare disease; and some cases which have been observed and subjected to careful examination have not improbably been either sarcoma or some mixed form of carcinoma and sarcoma.

Cancer of the body of the uterus originating in the mucosa varies in form according as its seat of origin is the utricular glands or the superficial epithelium. The most ordinary case of carcinoma of the body appears to begin in the utricular glands. These glands at the site of origin become blocked by the proliferation of the epithelial elements. Distension of the lumen follows the blocking of the glands, the blood-vessels in the inter-glandular spaces become obliterated, and occasionally deposits of pigment take place. At a comparatively early stage of this process, hardening or nodulation, with a certain amount of projection into the lumen of the uterine canal, occurs; and simultaneously there is development towards the muscular tissue of the uterus. The condition usually met with on examination of the uterus after extirpation is that of an alveolar cancer deeply invading the muscular tissue of the uterus; sometimes with nodules bulging upon the peritoneal surface, and invariably with a certain amount of ulceration towards the uterine cavity. This is the *adeno-carcinoma*. It is thus designated because of a distant resemblance to gland tissue which it assumes, but, as will be shown later, it is not adenoma malignum in the narrower sense. When the cancer begins in the superficial epithelium of the uterine mucosa, with invasion of the deeper tissues, there is also a papillary formation somewhat analogous to the cauliflower excrescence of the vaginal portion of the cervix. It may, however, take the form of mere superficial proliferation with necrosis and ulceration, forming a tumour comparatively late in its development. This is the adeno-carcinoma papillare of Pfannenstiel. Many of the cases described are probably epithelioma just as it occurs in the cervix. These, as Fritsch points out, are mere forms of the development of the disease in different varieties of cancer, and both forms may occur in the same case.

About ten years ago, in some of the German special journals, accounts of cases called epithelioma (*Hornkrebs*) began to appear from time to time. Hofmeier described two cases of squamous-epithelial cancerous tumours of the body. In one the diagnosis was by the curette and microscope, as total extirpation could not be effected; in the other case both a tumour of squamous-epithelial formation and a glandular carcinoma occurred in the same uterus. The patient was a virgin of fifty; menopause at forty-one; hæmorrhage for one and a half years; last half-year purulent discharge in addition. Vagina narrow, portio short, tumour size of a fist and half bulging through cervix from cavity of body; curette used for diagnosis. Microscopic examination led to the belief that it was sarcoma. Operation by combined abdominal section and vaginal method. Most of the tumour was ultimately found to be alveolar cancer, but part of it was unquestionably pure squamous celled epithelial carcinoma.

Since these early cases were reported with explanations and apologies for their existence, the occurrence of epithelioma of the body became generally recognised as by no means rare. As confidence in their diagnosis grew among the clinicians, the pathologists with their microscopes also acquired confidence, and now epithelioma of the corpus uteri is one of the commonplaces of diagnosis.

Hitschmann even generalises. He describes seven cases of typical adeno-carcinoma of the corpus uteri with "metaplasia" of the epithelium, and three cases of pure squamous-epithelial carcinoma. He concludes that metaplasia of cylindrical epithelium into squamous epithelium occurs very frequently in these cases of carcinoma; not only the superficial epithelium, but that of the glands undergoes the metaplasia. The squamous-epithelial masses may become cornified or keratinised (*verhornen*) and ultimately become calcified (carcinoma psammosum).

Etiology.—Cancer of the body is comparatively so rare that we have no great volume of statistics to appeal to and manipulate in the endeavour to find some clue to the cause of the disease. One thing i certain, that the most striking facts connected with cancer of the body are entirely different from the corresponding points in cancer of the cervix. In cancer of the body the patients are on the average much older—in the ratio of about fifty-five to forty-five; they are in different position in life, usually much better cared for from beginning to end of their lives than the class of women most frequently affecte with cervical epitheliom; and whereas the subjects of cervical epitheliom are, with few exceptions, parous,—most of them are multiparous, many them remarkably prolific,—the subject of corporeal cancer is almo invariably either elderly maiden or barren wife. Probably many of the apparent exceptions are explained by sarcoma of the body being diagnosed as carcinoma.

The *symptoms* of cancer of the body of the uterus in its early stages are as constant as the symptoms in the corresponding stage of epithelioma of the cervix. The most frequent is hæmorrhage, which in the post-climacteric case is characteristic. In cases in which the disease occurs before the menopause, the hæmorrhage at first bears some resemblance to that which is caused by fibromyoma of the uterus. It is often menorrhagia, a profuse and prolonged menstruation, not an ordinary metrorrhagia. Too much perhaps has been made of this symptom in the ante-climacteric cases, as the number of cases reported is comparatively small, and generalisation a rather rash proceeding; in differential diagnosis too little has been made of the fact that fibroids producing hæmorrhage in the immediately ante-climacteric period of life are usually well known to exist, and the cause of the hæmorrhage is consequently known. Besides, such fibroids are almost invariably sufficiently large to settle, without further consideration, the question of cancer of the body of the uterus. In the great majority of cases the hæmorrhage has recurred after the complete menopause. It is, as a rule, comparatively slight, and at first there is no other symptom at all; there may be lumbar or hypogastric aching from the congested condition of the uterus, and from the reopening of the senile internal os uteri. The hæmorrhage is slight and may be almost continuous, and there may or may not be some leucorrhœal discharge between the periods of bleeding. When the cancer assumes a form of superficial epithelial change, producing a localised comparatively hard mass acting like a foreign body, pain comes comparatively early, and ultimately is acute, at times it may be agonising; it is also frequently paroxysmal, and this, taken with the existence of great hypertrophy of the muscular tissue of the uterus, suggests that pain is caused by an effort of the uterus to shed or expel the diseased endometrium like a foreign body. In cases of another class pain may be trifling or almost absent to a comparatively late stage of the development of the disease. Even in the later stages of malignant disease of the body of the uterus, there is no pain analogous to that which arises in cancer of the vaginal portion and cervix, from infiltration of the parametrium and interference with the neighbouring organs, especially with the urinary organs. The pain in the later stages is not from pressure, but from peritonitis. In one case upon which I operated several years ago, the peritonitic pain was extremely well marked after paroxysmal pain had disappeared under treatment; and on extirpation it was found that a considerable quantity of fluid, which was turbid and contained shreds of lymph, had collected in Douglas's space; and bosses of cancerous material were found bulging upon the peritoneal surface.

Another point with regard to the pain of cancer of the body, when it does occur, is that after the first hæmorrhage there is no symptom analogous to the distress from tension produced by pyometra which, by closure of the internal os, is so often a complication of epithelioma of the cervix uteri. "The intense agonising pain at an early stage of the disease," of which Gusserow speaks, appears to be symptomatic only of circumscribed adeno-carcinoma of the body.

Another constant symptom of cancer of the body of the uterus is a discharge—not hæmorrhagic or sanguineous. As compared with cancer of the cervix, however, this symptom comes on comparatively late, and the discharge is different. It is different in being thinner and less turbid, and although fœtid, it is usually much less offensive. The absence of the intensely offensive odour of cancer of the cervix is probably due to the absence of infection by bacteria. It is, perhaps, also on account of the comparatively late occurrence of infection of the ulcerating surface that sapræmic symptoms, with emaciation and cachexia, are comparatively late in appearing in a case of cancer of the body. In all the cases which I have seen, the least developed of which was twelve months from the beginning of the hæmorrhage, the aspect was that of anæmia, not of cachexia.

The other symptoms and complications arising from cancer of the body are late in appearing. Metastases do not readily occur, and even infection of the lymphatics, after repeated curettings and interferences with the uterus, is strangely slow in appearing.

With the invasion of the lymphatics in uterine cancer comes the reaction of the connective tissue invasion which produces fixation of the uterus; and in the absence of lymphatic infection in cancer of the body is probably to be found the explanation of the fact that in this disease the uterus is seldom if ever found to be fixed until a very advanced stage of the disease is reached. Lymphatic invasion in cancer of the body is said even by advocates of Wertheim's operation to occur in less than 10 per cent of the cases.

Diagnosis.—In a case of cancer of the body after the completion of the menopause, there should be comparatively little difficulty in establishing a diagnosis. It may be difficult or impossible before operation to say what form of malignant disease exists, but the diagnosis of malignancy should not be difficult, and this is sufficient for all practical purposes. The particular form of malignant disease is seldom diagnosable from the symptoms and from the examination of shreds of endometrium; and, when the extirpated uterus is in the hands of the pathologist, it is sometimes even then a matter of doubt.

When malignant disease of the uterus occurs before the menopause, there are only two other conditions or combinations of these which can produce symptoms likely to lead a well-informed practitioner into difficulty. These are necrosing fibroid polypus or subserous fibromyomatous tumour, and incomplete early abortion with slight bacterial infection.

In the case of cancer of the body, the cervix on digital examination gives, as a rule, the impression of being unchanged. The lips may be thinned out in cases of a class already referred to, but, as a rule, no suc change has taken place. It is stated also, by some authors, that the exposure of the vaginal portion by the speculum does not assist the diagnosis. In the cases which have come under my observation there has always been a change in the endometrium, even of the vaginal portion. There is a suggestion of activity and hyperæmia, an indescribable change of colour of an unwholesome kind. It is a hyperæmia confined to the mucous lining without any other obvious change. On physical examination, per vaginam and bimanually, the uterus may not be found greatly changed in size or shape. In old virgins the examination should be invariably made with the aid of an anæsthetic, and then it will be almost certainly found that the changes ascertainable by palpation are sufficiently marked to arrest attention.

Some slight departure from the normal symmetry of the organ, a greater or less departure from homogenity in the resistance to pressure, hardness, softness, or elasticity, are signs which must receive attention, and to which due weight must be attached in the diagnosis.

When the diagnosis of well-marked disease brings up the question of such a serious operation as total extirpation, there is much to be said for complete exploration by dilatation so as to permit the entrance of the index finger into the cavity; but this proceeding, not without danger in the senile, is apt to produce metritis, or endometritis, or peritonitis, which may greatly embarrass the subsequent operation, and make it more dangerous. Such manipulations are also undesirable on account of the ever-present risk of producing sudden activity of the malignant process which, after the production of a wound, might possibly result in lymphatic infection or in some other local infection by contact. Rapid dilatation, it may be with the aid of an anæsthetic, and the use of the sharp curette or spoon, should make a final and definite diagnosis possible at once. There is nothing else in nature like the shreds thus obtained in a genuine case of post-climacteric malignant disease. It may be objected that the broken-down tissue of a sloughing fibroid is extremely like the tissue of a spindle-celled sarcoma. This is one of the cases in which assistance in diagnosis may be obtained by careful microscopic examination. If any doubt still exists,—though the differences revealed by the microscope are usually so obvious that any further difficulty becomes hardly conceivable,—there is always the history of the case to guide the judgment. With a definite history, such as may be obtained in cases of post-climacteric activity in the uterus, neither dilatation nor curetting may be necessary to a diagnosis justifying operation. The use of the uterine sound, or, better still, of a long surgical probe, gives the impression of either roughness and irregularity, or irregularity and friability in the body of the uterus, that has no parallel in uterine disease. The probe, even when used in the gentlest fashion, is perceived to sink into the friable tissue, and such trifling manipulation is usually followed by an altogether disproportionate amount of hæmorrhage from the senile uterus.

The differential diagnosis of ante-climacteric cases from fibroid tumour, or retained portions of early blighted ovum, may be worth consideration, although, a short period of observation being granted for the purpose of diagnosis, any important difficulty is hardly conceivable. In the case of blighted ovum there must be something in the circumstances implying the possibility of pregnancy, and a history of symptoms suggesting the occurrence of pregnancy. Even with an offensive discharge, the appearance of the uterus when exposed by the speculum and volsella is altogether different from that which contains a malignant tumour; the physiological as contrasted with the pathological colour of the mucosa is unmistakable; and, finally, dilatation permitting the use of the curette must at once dissipate any doubt as to the nature of the condition: a tumour, however friable, is attached, and usually ill-defined; a retained portion of ovum is in a definite plug, free to come away on slight handling.

In the case of sloughing fibroid in a woman before the menopause, the circumstances may be such as to make the diagnosis doubtful until part of the tissue is examined; but this must be a very rare occurrence. The differential diagnosis should in such cases be purely clinical. The hæmorrhage in the case of the fibroid is profuse menorrhagia; the intermenstrual discharge, if the patient have undergone no treatment, is hydrorrhœa, not a malodorous, turbid, sanious, or dirty-water discharge. However anæmic the patient may be from the loss by hæmorrhage and discharge, the cervix, as revealed by the speculum, will give the impression of health.

In the case of fibroid subserous tumour or polypus, the cervix will be comparatively soft, and the cervical canal more or less dilated. If any doubt continue to exist, dilatation to permit of digital examination may have to be effected, and some portion of the tissue removed. The only possible smooth, circumscribed tumour which can simulate fibromyoma is sarcoma; and an easy, rapid, microscopic examination of even a particle of the débris of tissue should finally settle the question. But no such question need arise. The naked-eye appearances of the two tumours are distinct: the sloughing fibroid, even when blackened in colour, is not so easily torn, and when torn still shows the fibrous structure in the shreds; the malignant tumour, like all malignant tissue in the uterus, if not soft, is always friable, and is thus easy to distinguish from any possible form of fibromyoma in any condition which it ever assumes.

The prognosis in cancer of the body of the uterus is much more favourable than in malignant disease of any other portion of that organ. It is long after the initial stages of the disease that lymphatic infection occurs; and consequently fixation or even embarrassment of movements of the uterus is an incident of an advanced stage only. This long continuance of mobility greatly favours surgical treatment; and, as a matter of experience, comparatively few cases of this affection come into the hands of the gynæcologists in an inoperable condition.

Döderlein (37) gives a tabular statement showing the permanen cures after operation in collum- and corpus-carcinoma, which is ver instructive. Of cases operated upon, Leopold had permanent relief in collum carcinoma 50 per cent, in corpus carcinoma 100 per cent. Fritsch had 34·3 and 100 per cent respectively; Chrobak, 31·5 and 75 per cent; Döderlein, 28·5 and 100 per cent; Schauta, 26·4 and 83·3 per cent.

My experience of the results of operation for corpus carcinoma is very satisfactory. I have operated in sixteen cases in seventeen years, and a few months ago I could have said all the patients were still alive and well. Two patients on whom I operated upon seven and three years since respectively have recently died: they were the only multiparous women in the sixteen cases of cancer of the body. The patient with alveolar cancer of the body, operated upon some seventeen years ago, is in apparently perfect health.

The immediate danger of operation is an important factor in the prognosis. An important source of danger in the course of the operation —one which, perhaps, may not be sufficiently guarded against—is that of infection of the vaginal or of the peritoneal wound. In many cases of recurrence after cancer of the body the disease could be distinctly traced to contact-infection.

Treatment.—When cancer of the body of the uterus is diagnosed before fixation has occurred, or before complications and lymphatic infection have made operation useless, there is only one method of treatment to be considered; that is, total extirpation per vaginam.

The experience of every year gives greater confidence to the advocates of this method of treatment. The technique of the operation continues to improve, and all experienced operators bear testimony to the smallness of the immediate risk to life and the excellent prospects of perpetual immunity.

Much harm is frequently done by temporising and meddling in an ineffectual way. There is in too many cases a history of medical treatment without examination; or of repeated explorations without any fixed scheme of procedure to follow the observations thus made. Again we learn that the curette has been used, and something applied, and that the symptoms to some extent improved; this merely implies in all probability that the hæmorrhage temporarily disappeared, and thus still further time was lost. After the least possible amount of manipulation consistent with forming a confident diagnosis, the operation of total extirpation should be performed without delay.

With regard to the operation, there is little to be said that does not apply to the same operation of hysterectomy for any other condition. One danger to be avoided is to prevent contact-infection, and consequent early recurrence, from extravasation of the cancerous fluid. In portio cancer you may use the curette or scissors as the first step in the operation; the analogous step in corporeal cancer is to suture the external os so as to prevent any fluid from escaping. A difficulty frequently arises from the senile condition of the vagina and parts generally. So difficult is the operation sometimes made by the narrowness of the vagina in an elderly maiden, that it is possible to complete it only by making a free deep incision through the perineum, or by para-vaginal section. On account of this difficulty many operators have recommended the sacral operation, and probably still more the combined vaginal and abdominal method. We have seen, however, how terribly fatal Freund's operation is in even the best hands, and the drawbacks of the sacral method are too serious to justify it save under very exceptional circumstances. I do not regard the difficulty of a narrow vagina and senile change as so great as it has been sometimes represented. Hardly any operation of the kind could appear more formidable than one which I performed recently on a virgin of over sixty years; but my first step was to make a free incision in the middle line of the vagina from an inch below the uterus right down and through the perineum to the sphincter ani. The last step was to stitch up this wound, and it healed perfectly without reaction or flaw. Para-vaginal section makes a cleaner operation and gives still better results.

In a far-advanced case, when radical operation is out of the question, the methods of giving relief are exactly those employed in inoperable cancer of the vaginal portion and cervix. The prospect of keeping the patient fairly comfortable is moderately good. Hæmorrhage can be kept within bounds by use of the curette and tampon. The danger here is rather uræmia than septicæmia; it is the blood-poisoning and accompanying fever which sap the strength. Hence the need for every effort to keep the area affected as nearly aseptic as can be managed.

The complications of the later stages of cancer of the body differ considerably in an anatomical sense from those produced by disease beginning in the cervix; but the symptoms are practically identical, and the methods of giving relief from sufferings are the same.

IV. Adenoma Malignum

Adenoma malignum occurs as a definite form of malignant disease of the uterus. Many cases have now been recorded in detail, and although on many points our knowledge is as yet incomplete, the disease merits separate study and description. It may develop in the body of the uterus or more rarely in the cervix. It is much more uncommon than adeno-carcinoma, but sufficient material is not yet available to allow of definite statements as to the relative frequency of its occurrence. We know enough to say with confidence that it has characteristics distinguishing it from adeno-carcinoma.

In the body of the uterus the disease usually commences as a diffuse overgrowth of the uterine glands, and throughout its course the definite glandular type persists. In its simplest form it closely simulates the benign adenoma: the epithelium remains limited to a single layer of columnar cells, which show no tendency to polymorphism or to proliferation as solid masses invading the stroma. Portions of tissue removed reveal nothing more than glandular overgrowth. If, however, the uterus is examined after removal, the glandular tubercles are seen to be deeply invading the muscular wall, and are surrounded by an area of stroma infiltrated by round cells. This type of malignant adenoma has led to many mistakes in diagnosis and much delay in carrying out efficient treatment. The sole test of malignancy is deep invasion of the uterine muscle, and microscopically it is undistinguishable from benign adenomatous disease of the uterine mucous membrane. Frequently, however, malignant adenoma presents very definite features which are absolutely characteristic. The shape of the uterine glands is entirely changed, and long narrow tubercles, closely set together and lined by cylindrical epithelium, invade the stroma. Two types may be recognised. In one the glands are enormously enlarged by enfolding of the epithelium into the lumen, *adenoma malignum invertens* (Gebhard). Long parallel columns of glandular epithelium invade the uterus wall, destroying the stroma, so that frequently the epithelial cells of two tubules are almost in apposition. In the second type the glands have enlarged by outgrowth of epithelium as excrescences into the stroma, *adenoma malignum evertens* (Gebhard). The appearance of gland-like parallel coils of tubules is lost, the whole growth being composed of small glandular spaces with very little intervening stroma. The epithelium retains its single layer of cylindrical cells, but in this type solid buds may be recognised invading the tissues, although the glandular characters are retained throughout.

It has been by some alleged, as already stated, that adenoma malignum is a form of adeno-carcinoma, and that as such it does not merit separate consideration. Cases recorded by Hofmeier, Selberg, Landerer, and others show, however, that it is a definite type of disease strictly comparable to malignant adenoma of the stomach, rectum, and other glandular organs. The chief points of distinction between adenoma malignum and adeno-carcinoma lie in its definitely glandular type, as shown by (*a*) the single layers of epithelium, (*b*) absence of polymorphism of the cells, (*c*) no solid alveoli are found. There is also less tendency to ulceration and necrosis, though this occurs at a later stage when the stroma is completely destroyed. The disease usually runs a much slower course than adeno-carcinoma. A typical case illustrating all the points of difference is reported in *Trans. of Obst. Soc. of London*, 1903.[1]

Genuine metastases may occur in the vagina or the cicatrix after removal of the uterus; also in the lungs, liver, and other parts of the body, and these always retain the glandular character of the primary disease.

Malignant adenoma of the cervix is a rare affection. It is characterised by glandular hyperplasia with early invasion of the deeper structures of the cervix. The gland tubules assume an irregular form, and become much enlarged; the epithelium proliferates, but the glandular type remains distinctive. The cervix becomes hard and infiltrated; ulceration occurs comparatively late in the disease. In one case under observation the growth did not break down under the application of a sharp curette, and the diagnosis was made by microscopic examination of an excised portion of the cervix. In this case the growth was highly malignant, local recurrence taking place three months after total extirpation of the uterus (Figs. 101 and 102).

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[1] "A Case of Adenoma Malignum of the Body of the Uterus." C. Hubert Roberts.

Symptoms.—These are essentially those of malignant disease of the body of the uterus. The disease is most frequently post-climacteric, but it may also arise during active sexual life, especially in parous women. There exists in some cases of "benign" adenoma a distinct tendency to take a malignant action. Two illustrative cases may be mentioned occurring in women during middle life who had borne children. The uterus was in each instance curetted for hæmorrhage; the fragments showing typical "benign" adenoma. A few months later the symptoms recurred, and the uterus was found to contain a mass of soft growth. Extirpation was performed in both cases. The glandular growth, which still retained the characters of simple adenoma, was seen to be deeply invading the muscular wall of the uterus.

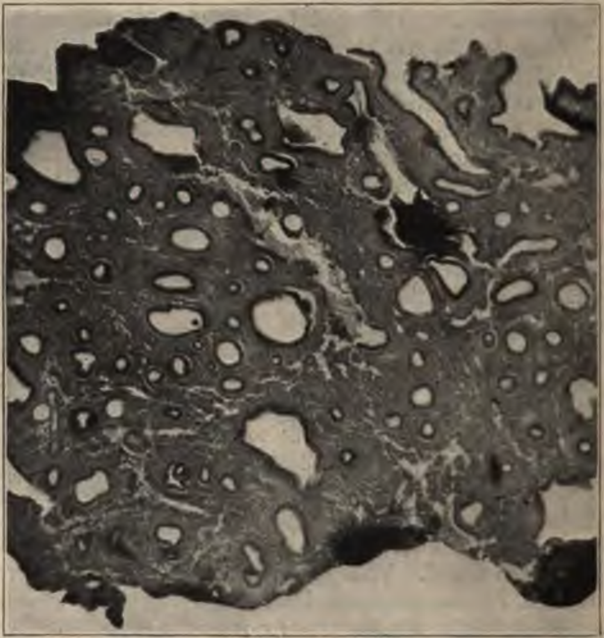

FIG. 101.—Adenoma malignum curetted fragment This is undistinguishable from benign adenoma by the microscope.

In the post-climacteric cases the onset of the disease is usually insidious, and it is relatively less malignant than adeno-carcinoma. Hæmorrhage, often profuse, is for some time the only symptom, and there is an absence of fœtor in the discharge. At a later stage necrosis and ulceration of the growth takes place. Pain is often absent, unless the uterine ity is distended by the growth. At a late period the disease manifests the features characteristic of cancer of the body of the uterus.

Diagnosis.—Malignant adenoma may closely simulate diffuse benign enoma or chronic glandular endometritis, especially when it develops ring active sexual life. The uterus is usually enlarged, and exploration h the curette reveals masses of growth. These may give definite dences of malignancy under the microscope, but a negative result does disprove malignancy. In practice it is wise, if symptoms recur after rough curetting and the uterus is again found to contain growth, to treat condition as malignant and adopt radical measures. A striking case is orded by Landerer in which a woman æt. 48 had suffered for four years m hæmorrhage. The uterus was the size of a man's fist. The curette noved two tea-spoonfuls of soft tissue. A diagnosis of chronic ndular endometritis was made. Hæmorrhage again recurred, and the ient became much reduced. Again curetting was carried out, without nefit. At length, one year later, the uterus was removed. The cription of the growth clearly shows it to have been malignant noma from the first.

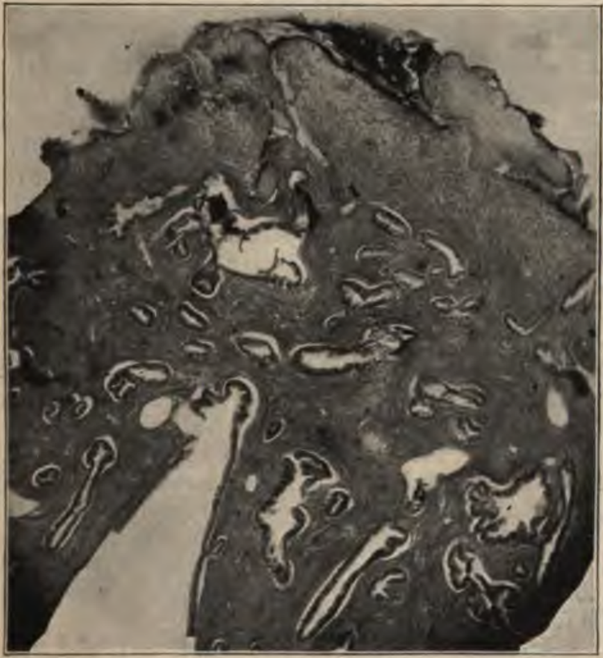

FIG. 102.—Adenoma malignum of cervix uteri.

All activity of the endometrium about the climacteric or afterwards, ich is not completely accounted for by other ascertainable causes, should be looked upon as malignant. Mucous polypi are often present. These may be single, but they may also be associated with adenomatous polypi in the endometrium. If they are found to extend into the cavity of the uterus the condition is almost certainly malignant, and extirpation should be carried out without delay.

It may be stated definitely that all post-climacteric polypoid or fungous conditions of the endometrium are adenoma malignum.

V. Sarcoma Uteri

Sarcoma is a comparatively rare form of malignant disease of the uterus, and observations upon it are comparatively recent. Still, it occurs with sufficient frequency to make it a matter of importance to the practical gynæcologist, and not merely a subject of scientific interest to the pathologist. Sarcoma of the uterus has been found in the child, and it may occur at any time of the woman's life; but most of the cases described have been just before or after the menopause.

Classification.—An obvious and perhaps useful clinical division of cases of sarcoma is into the three groups—

1. Sarcoma of the body of the uterus.
2. Sarcoma of the cervix.
3. Sarcoma of the vaginal portion.

As distinguished from the occurrence of carcinoma, the most common site of sarcoma is in the body of the uterus. In 403 cases of malignant growth of the uterus reported from Halle, 387 were carcinoma and only 15 sarcoma, and 10 of these were sarcoma of the body.

There are three well-defined forms of sarcoma of the corpus uteri. One is the form occurring in masses or tumours, which is so often mistaken for fibromyoma; another is the diffuse form found in its early stages in or near the endometrium, and bearing a strong resemblance clinically to carcinoma of the body; the third form is sarcoma botryoides, which calls for little attention here.

The development of the first-mentioned variety has a striking resemblance to the growth of fibromyoma; and in fact all the details in the study of it are closely analogous to those of myomatous tumours. A woman approaching the climacteric period of life is informed that she has a tumour of the uterus. She is led to look forward to abatement of the symptoms and diminution or disappearance of the tumour with the cessation of menstruation. Instead, however, of her hopes and expectations being fulfilled, the tumour, which may have been almost or altogether stationary, begins to grow, the hæmorrhage increases and becomes irregular, or it is replaced in time by a thin, watery, sanious discharge. The fibromatous tumour, which has been painless, begins to cause uneasiness, and ultimately gives rise to intolerable pain. The patient takes on an aspect of suffering and deterioration of health not sufficiently accounted for by the anæmia caused by the discharge; she gradually loses flesh and assumes a cachectic appearance. When examined after some weeks or months of routine medical treatment the uterus is found to be fixed, and the floor of the pelvis has the stony hardness of the middle stage of perimetritis. The infiltration of the tissues of the broad ligament affects the ureters and kidneys in the same way as the corresponding stage of cancer of the cervix, and the termination may be the same; or symptoms due to metastases in distant organs may arise, and the fatal termination come rapidly.

These are the chief facts in the history of a case of fibrosarcoma uteri, the form of the disease which is due to the transformation of fibromyoma into sarcoma. It is, I believe, by far the most common of the forms of sarcoma of the uterus, although some regard the diffuse form in the endometrium as the most frequent.

The second form of sarcoma of the body, as usually described, closely resembles the diffuse form of carcinoma of the uterine mucosa; and it is only to be clearly distinguished from carcinoma by the microscope. And in some cases there has even been a difference of opinion among competent clinicians and histologists as to the exact nature of the neoplasm, with the clinical symptoms and the microscopic appearances of removed tissues in evidence. In some of these cases there has probably been some intermediate condition between carcinoma and sarcoma.

A variety of this form is cystic sarcoma, of which a considerable number of cases have been described by competent observers. This is, pathologically, merely a cystic conformation of the interstitial variety, or myoma sarcomatodes; but it has sufficiently definite clinical features to require a separate classification and description for the efficient exposition of its characters, their origin, and their practical consequences.

Again we have myxo-sarcoma, as described by Dr. Amand Routh (74), declared by a committee to be "fibro-myoma, showing extensive round-cell infiltration," obviously a very doubtful class of benign growth. Gessner (70) speaks of a case of chondro-sarcoma, while he is disposed to doubt the existence of combined sarcoma and carcinoma in the uterine mucosa.

Many cases of sarcoma of the body of the uterus have been described as exhibiting such individual peculiarities that it would not be possible to reduce them to any classification which could serve a useful purpose. We must rest satisfied in such circumstances with describing all that pertains to the individual case. The same remark applies to sarcoma of the cervix. It is a comparatively rare disease, and the anatomical situation is the only thing sufficiently in common to serve as the nexus for any clinical account of the individual cases. The most striking form occurring in the cervix is the sarcoma botryoides or grape-cluster tumour, met with not only in children, but at any later period of life.

Pathological Anatomy.—*A.* The *interstitial* form of sarcoma is analogous in structure to the fibromyoma of the uterus, as it is frequently, perhaps always, a transformation of the common benign tumour. Some of the cases described, even when definite tumour masses existed, appear to have been soft sarcoma derived from the endometrium. As a rule, the new growth consists of one or more circumscribed masses, not to be distinguished by form or consistency from myoma. They are probably the "œdematous tumours" which gynæcological surgeons remark on as uninfluenced in their growth by castration. Histologically they show a proliferation of round cells, more or less replacing the normal tissues of the uterine wall. From Virchow and Schröder to the present time the vast weight of authority has been in favour of the view that interstitial sarcoma is a malignant transformation or degeneration of the ordinary fibromyoma; and many sarcomatous tumours have been described which exhibited marked traces of their origin. It would be superfluous to quote authorities or describe even typical cases to substantiate and illustrate that which all recognise and accept.

An attempt has been recently made to prove from the histological examination of operation material that sarcomatous tumours may arise from the muscular tissue elements of the uterus. Dr. Whitridge Williams has published a paper, highly valuable in many other respects, in which he describes a case under the designation of sarcoma-like myoma of the uterus (myoma sarcomatodes uteri). Williams came to the conclusion that the new growth was derived from a proliferation of the muscle cells, and not from the connective tissue. After quoting some questionable authority, he proceeds to say: "It is evident that fibromyomata may be transformed into sarcomata either by the proliferation of the connective tissue cells between the muscle bundles, or by the proliferation of the muscle cells themselves."

Pure spindle-celled sarcoma also occurs. Such tumours, when they soften and disintegrate, shedding their débris through the uterine canal, give rise to symptoms which closely simulate those of sloughing fibromyoma. The analogy of the fibromyoma still holds even with regard to pedunculated tumours. These also have been found undergoing sarcomatous transformation.

Whether such tumours may have also a capsule like a circumscribed fibroma used to be a disputed question. So many cases have, however, been observed by competent clinicians and pathologists in the transition stages, that it may be stated as a fact beyond further discussion that even malignant tumours of the body of the uterus may have a distinct capsule, and may to this extent correspond still further in structure with the benign tumours.

B. Diffuse sarcoma of the corporeal mucosa resembles, as has been said, the typical form of carcinoma of the same structure. "The term diffuse sarcoma, sarcoma of the uterine mucous membrane, has been used since Virchow's time to designate a new growth proceeding from the connective tissue of the uterine mucous membrane, consisting mostly of small, closely packed, round cells, though sometimes of spindle cells, and constituting an exceedingly soft, friable infiltration of the mucous membrane" (15).

C. The third definite form of sarcoma of the uterus, *sarcoma botryoides*, or grape-like sarcoma, affects the cervix and occurs in the years instantly after puberty or after the menopause. A few cases which may be included in this class have been described as sarcoma of the corpus uteri. The first case appears to have been reported by Spiegelberg in 1872. A considerable number of cases were described, and the pathology was discussed during the next twenty years, and various names were suggested, until Pfannenstiel published his monograph in 1892, and proposed the term "das traubige sarcom," or grape-like sarcoma. He opposed the view that the disease was a myxoma, and accepted Wiegert's explanation of the histological appearances, which, indeed, in its essential points may be considered as established. The cyst-like masses, resembling hydatid mole, consisted chiefly of large, round, and spindle cells, with clear spaces separating them. These spaces were traversed by a network of fine thread-like tissue and blood-vessels, and were filled with lymph corpuscles. The new growth was œdematous, not myxomatous; and its attenuated enclosing structure consisted of squamous epithelium, which was covered by a layer of cylindrical cells with indistinct cilia. The cavities containing lymphatic fluid were not lined with epithelium, and therefore not glandular. The growth in Pfannenstiel's case took its origin from the superficial parts of the mucosa of the cervix, and derived its peculiar conformation from the papillary structures at its site of origin. The ultimate factor in its origin appeared to be some change producing proliferation in the lymphatics and blood-vessels.

Perhaps the most important of recent contributions to this subject is that of Pick, whose conclusions may be shortly stated. Sarcoma botryoides, as observed in the cervix uteri of adult women and children and the vagina of children, is in every respect a special variety of tumour characterised by its grape-like form. Clinically, it is extremely malignant. Anatomically, it develops from the most superficial layer of the mucous membrane; it spreads first in the superficial portions of the mucosa; it shows a strong tendency to invade the deeper tissues; and it assumes the grape-like form owing to the freedom with which it may expand and become œdematous in the wide cavity of the vagina. The extreme rapidity of development of this form of sarcoma is accounted for by its greater virulence and the rapid circulation of the lymphatic stream in the subepithelial layers. The grape-like conformation is explained by the original papillary development, the freedom for expansion, and the dropsical condition brought about by interference with the blood and lymphatic circulation at the neck of each individual papillary element.

Symptoms and Course.—As compared with carcinoma, it may be said that all the forms of sarcoma run a more rapid course than the corresponding carcinoma, after the symptoms first attract attention.

It would be useless to attempt to separate the various forms in any general description of the symptoms produced; indeed, it is not possible to establish exact diagnostic symptoms marking them off from carcinomata, for whatever suspicions may be aroused and surmises made, the differential diagnosis is only established by means of the microscope, after operation or death.

The fibrosarcoma gives rise at first to the same symptoms as the fibromyoma. It is only when a tumour begins to grow rapidly at the time it ought to diminish that the suspicion of malignancy is excited. It may be laid down as a rule, with few if any exceptions, that an apparent fibromyoma which begins to grow at the menopause is undergoing sarcomatous transformation.

When post-climacteric growth of the tumour occurs, two symptoms soon appear. One is pain owing to tension resulting from the rapid growth, and often from invasion of the circumuterine connective tissue; the other is marked deterioration in the general health.

Hæmorrhage is in much more than half of the cases the first and most striking symptom of sarcoma. As the disease develops it is absent in extremely few and exceptional cases. If the neoplasm is developing from a submucous fibromyoma or polypus, there will be severe hæmorrhage, and pain from the efforts of the uterus to expel the tumour. If such tumour be removed, there is soon recurrence; but the expulsion of several polypi at intervals, although suspicious, is not to be considered diagnostic of malignancy. It may be "recurrent fibroid," and therefore malignant; but it may be, and in the pre-climacteric case more probably is, merely expulsion of several previously existing submucous fibroids which have shrunk on account of senile changes. As the sarcomatous neoplasm advances in growth, in addition to occasional violent hæmorrhage, it may cause a sanious hydrorrhœa, even though it is not necrosed. Such discharge is the first symptom in about one-fourth of the cases. This discharge, sooner or later, takes on an offensive odour. The tumour, moreover, may become gangrenous, and give rise to septicæmia more or less acute, according as surgical treatment has been attempted or not.

Death is readily produced by the intense anæmia and sapræmia, by peritonitis or obstruction of the intestines; or from pressure on the ureters. It is often preceded by œdema of the abdominal walls and legs, partly from pressure, partly from failure of the heart.

In the diffuse mucous form of sarcoma the symptoms are not distinguishable from carcinoma affecting the same structures. There is usually a profuse leucorrhœa occasionally mixed with blood; and severe hæmorrhage may occur, but not as a rule. It is rather persistent and irregular. Pain is absent, as a rule, early in the development of the disease; cases have been mentioned in which it was entirely absent. As a rule it comes in the form of a feeling of discomfort as the tumour increases in size, more like the symptoms at first produced by prolapse of the uterus in a sensitive person. It usually becomes severe when the disease has extended beyond the uterus and produced fixation. When spasmodic pains like labour occur they are usually the result of efforts on the part of the uterus to expel the new growth as if it were a foreign body. It may be, as suggested by Gusserow, that infiltration has penetrated, and that the immediate cause is "some morbid change in the terminal nerve filaments."

Later in the course of the disease the peritoneum may become invaded, or the disease may penetrate the walls of some of the neighbouring organs.

Metastases are rarer than in fibrosarcoma, but the diffuse mucous form extends continuously at a greater rate.

Diagnosis.—With the exception of the rare sarcoma botryoides of the cervix, sarcoma cannot be positively diagnosed without microscopic examination, and sometimes not even then.

One of the most remarkable cases in the literature of this subject well illustrates the difficulty of diagnosis occasionally met with, and suggests inferences for our guidance. Dr. Griffith reported (69) a case of sarcoma of the uterus which was evidently at first diagnosed and treated as fibroid tumour. After recurrence of the growth the uterus was extirpated. The specimen was referred to a committee for examination. The committee's report is interesting: "Dr. Griffith reports that the patient has died with metastases in the lungs and thoracic walls. Taking this fact into consideration . . . the committee are of opinion that the growth is a sarcoma."

The first thing to be done is to observe the clinical symptoms carefully and endeavour to settle the question of malignancy. If the malignant character of the tissue-changes in the uterus be once definitely established and acted upon, there will be time to distinguish by suitable means the particular kind of tumour from all others which it simulates.

In the case of the sarcoma simulating fibromyoma, the diagnosis by microscopic examination of expelled portions of the tumour has often failed. Certain clinical observations are therefore of the highest value:—

1. The growth of a uterine tumour after the menopause.

2. The recurrence of hæmorrhage after the menopause in such a case.

3. The occurrence of cachexia unaccounted for in any other way in such a case of uterine tumour after the menopause.

4. When discomfort in the pelvis occurs in such a case which is not explained by any other diagnosable condition.

5. When, after removal of a supposed fibroid polypus, another polypus makes its appearance. The presence of hypoperitoneum, which is sometimes set down as a diagnostic mark, is not much to be relied upon; it is so easy to mistake the almost constant accompaniment of fibroma ovarii for the fluid resulting from malignant disease of the uterus or from other pathological changes. The early occurrence of fixation, on the other hand, is a point of some diagnostic value. The greater or less sense of density or softness conveyed in palpation does not afford much help in diagnosis.

Prognosis.—There is a remarkable difference of opinion among writers on the subject as to the comparative unfavourableness of the prognosis in sarcoma and in carcinoma. All are agreed as to sarcoma that it is malignant; no patient once affected ever recovers. It is said by some to be slower in its development in the earlier stages than carcinoma, and when treated by early operation to be less likely to recur than carcinoma. V. Winckel commits himself to this opinion, but adds that if operation be impossible this disease is generally more rapidly fatal than carcinoma. This implies that the later stages of inoperable sarcoma are more rapid than in carcinoma, although the earlier development is slower. Reports of individual cases do not seem quite to support this symmetrical generalisation.

Most are agreed that if surgical interference is once begun, the downward course is rapid if the uterus and affected area be not completely swept away. The reported exceptions are comparatively few, although some of them are striking. In recent years, when much attention has been devoted to radical surgical measures, a tolerable consensus of opinion has been formed to the effect that sarcoma recurs sooner than carcinoma after extirpation.

Treatment.—The treatment is radical or symptomatic. The radical treatment is the same as for carcinoma. If the uterus be movable, and there be no metastases or invasion of the vagina, the treatment is total extirpation without delay. This should be done by the vaginal method if possible; if this be impracticable, then by the combined abdominal and vaginal methods. If there be infiltration of the sacro-uterine folds or broad ligaments, even though extirpation is still possible, the advantages obtained in operating at so late a period in carcinoma are not to be expected. Recurrence takes place all the sooner, and the progress of the disease afterwards is so much more rapid.

In doubtful cases, which may have been diagnosed as sloughing or necrosing fibromyoma at or after the menopause, the rule should be operation per vaginam, by para-vaginal section if the vagina is narrow or senile.

VI. Endothelioma Uteri

This subject is mentioned here lest some readers might complain that it had been overlooked. In the present state of our knowledge, endothelioma of the uterus is of absolutely no clinical importance. It is a mere term in a nosology surrounded by a vapour of controversy.

Endothelioma is a term applied to a malignant growth originating in the endothelium of blood-vessels or of lymphatics.

The questions around it are: Is it a distinct form of malignant growth, or is it a form of carcinoma or sarcoma? Clinically it is in the individual case report stage of our knowledge. It is hardly worth while to go into any details on the subject. A typical case or two may be sufficient to sum up all we know.

Huizinga (93) of Groningen describes a case which he calls endothelioma portionis vaginalis uteri intra-vasculare. A woman of sixty-three with hæmorrhage—use of curette—removal of a tumour the size of a hazelnut from the anterior lip of the vaginal portion—microscopic diagnosis of endothelioma—extirpation of the uterus. The neoplasm originated in the endothelial cells of the small blood-vessels in the tunica propria of the mucosa of the cervix and perhaps also in the muscularis. It took the form partly of nodules of cells and partly of diffuse sarcoma.

A case reported by Cristalli (92) is still more difficult to locate in any system of applied gynæcological knowledge. He calls it "rare neoplastic association in the cervix uteri Malpighian epithelioma, complex angio-neoplasm with transformation (metaplasia) of the connective tissue and of the myometrium." After a minute description of the microscopic appearance, Cristalli concludes that he has met with a unique case, and that it is impossible to say whether the neoplasm originated as an epithelial or vascular growth. He does not employ the term endothelioma or perithelioma, but either or both might have been applied if the term epithelioma must be avoided.

W. J. Sinclair.

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CHORIONEPITHELIOMA MALIGNUM

(SYNONYMS: Chorio-epithelioma malignum; deciduoma malignum; sarcoma uteri deciduo-cellulare; syncytioma malignum; placentoma malignum; carcinoma syncytiale.)

The subject will be considered under the following headings:—I. Introduction. II. History. III. Morbid Anatomy. IV. Histology. V. Microscopical Diagnosis. VI. Ætiology. VII. Incidence. VIII. Clinical Features: *Symptoms; Diagnosis; General Course and Termination.* IX. Treatment.

I. Introduction.—Chorionepithelioma malignum is a malignant tumour of the uterus arising in connection, sometimes immediate but frequently remote, with a confinement or abortion; in many cases it destroys life with a rapidity almost unequalled by any other kind of growth. Clinically it is characterised by the occurrence, within a shorter or longer period after pregnancy, of irregularly recurring, often violent hæmorrhages, progressive anæmia and cachexia, sometimes fever with rigors. The morbid anatomy shows a hæmorrhagic tumour situated most commonly in the cavity of the uterus, occupying the fundus and adjacent portions of the anterior and posterior walls, *i.e.* the usual site of the placenta. In addition to the above, other evidences of malignancy are found in more or less ulceration, infiltration, and destruction of the uterine tissues, and in the rapid occurrence of metastatic growths, which are most common in the vaginal veins and the lungs, corresponding to a dissemination by the blood-stream. Histologically it presents a very characteristic picture, but at the same time a complex and rather confusing one, as, owing to the numerous modifications which the component cells undergo, they present an extraordinary variety of forms.

The most typical elements are:—

(1) Large multinucleated irregular masses of protoplasm (plasmodia or syncytia), in which no definite cell boundaries are recognisable.

(2) Small well-defined polyhedral cells with large vesicular nuclei, closely packed together in masses, without any connective tissue stroma between them.

(3) Large mononucleated or multinucleated cells, some of which present a resemblance to decidua cells, while others are identical in characters with the multinucleated giant cells which occur in the decidua serotina. These are, in some parts, arranged in cell masses without intervening connective tissue stroma; in other parts they are found infiltrating and destroying adjacent tissues in the same way as sarcoma.

Among the cell masses are seen the remains of the normal tissues, together with a large amount of blood, which is sometimes clotted, sometimes fluid as if in sinuses, and gives the tumour tissue its hæmorrhagic appearance. The growth has no blood-vessels of its own, and no proper connective tissue stroma, nor does it convert the adjacent normal tissues into stroma. On the contrary, a particularly active destruction of all normal tissues, especially the walls of the uterine blood-vessels, is characteristic of the tumour. To this feature it owes its hæmorrhagic character and its mode of dissemination.

The connection with pregnancy is essential, for the tumour is a special growth originating from a structure which is found only in connection with pregnancy, viz. the epithelium of the chorionic villi; the cells of the first class corresponding to the syncytium, those of the second to Langhans's layer, and the third containing derivatives of both layers. Its place in a system of classification depends on the view that is held of the nature and source of that epithelium. The original view that it was a tumour composed of decidua cells has been quite abandoned.

Chorionepithelioma is a particularly interesting tumour, both pathologically and from its embryological relationships; it is also important from the practical point of view, because it is by no means the great rarity that it was at first supposed to be. From 1889, when it was first recognised as a distinct variety of tumour, till 1903, nearly 200 cases were published; but this does not represent all that have been observed, for in the last few years the typical cases have been in many places no longer recorded. For example, in a period of eighteen months, from February 1901 to August 1902, seven specimens, all from fatal cases, were added to the museum of the General Hospital in Vienna; and several others were simply examined and then thrown out. In the period above mentioned about 2700 post-mortem examinations were made in connection with the General Hospital in that city. Practically all cases which prove fatal there are submitted to autopsy. Even seven deaths in that number is no inconsiderable proportion for a disease which was supposed to be a rarity; and when one considers that most of the victims were women in the prime of life who had enjoyed good health up to the fatal pregnancy, the importance of the disease is apparent. We are aware of six cases in Glasgow since 1898, only one of which did not prove fatal. Possibly other cases have escaped recognition, passing for retained placenta leading to sepsis, or for sarcoma.

At the same time, evidence is not wanting that chorionepithelioma has sometimes been erroneously diagnosed, and that operations have been too hastily performed. The extreme malignancy of the first reported cases gave grounds for the opinion that hysterectomy could not be done too early, but the records of numerous more recent cases show that the extremely malignant form is but one type, and that all degrees of malignancy may be met with just as in the other classes of tumour. The histological test has been proved to be by no means infallible, and neither clinically nor pathologically is it possible to draw a sharp line of distinction between mere cases of retained placenta or simple hydatidiform mole, which are curable by removal of the foreign material, and those which run on into chorionepithelioma or destructive hydatidiform mole. It is especially with regard to the last mentioned variety of the tumour that difficulties are met. The recognition of chorionic epithelium or chorionic villi is easy and certain, but it is a very different matter to decide whether the tissues are those of a simple hydatidiform mole, or those of a potential malignant growth.

II. **History.**—The evolution of the present view of the nature of chorionepithelioma may be briefly traced; the sources from which the whole history can best be obtained are indicated by the table of references. The history of deciduoma malignum begins with the description by Sänger in 1889 of a case of very malignant sarcoma-like growth of the body of the uterus, arising after an abortion in the eighth week. This he regarded not as a sarcoma coinciding with the pregnancy, but as a special tumour allied to sarcoma, in the causation of which pregnancy was an essential feature; in other words, a growth developed from a tissue peculiar to the gravid uterus, viz. the decidua; and he called it *deciduoma malignum*. In 1890 Pfeiffer, a pupil of Chiari, published an account of a very peculiar case, and classed along with it three cases which had been described by Chiari in 1877 as carcinoma of the uterus coinciding with pregnancy. Pfeiffer quite independently came to the same conclusion as Sänger, and also called the growth deciduoma malignum. Pestallozza in 1891 reported from Italy two cases of a highly malignant sarcoma-like tumour of the uterus connected with pregnancy, and also a third case which was a malignant hydatidiform mole with metastatic tumours in the lungs and vagina. In the last case Pestallozza recognised that placental tissues were capable of giving rise to a tumour, malignant both locally and generally. Cases similar to that of Sänger were also reported by Schmorl, Müller, Gottschalk, and others, who did not altogether accept Sänger's interpretation of the disease.

In 1893 Sänger published a monograph on the subject, in which he collected all the previously reported tumours that seemed to present affinities to his case, and described three varieties of malignant tumours directly connected with pregnancy:—

(1) Sarcoma deciduo-cellulare, *i.e.* sarcoma composed of decidua cells, corresponding to the original deciduoma malignum.

(2) Sarcoma deciduo-cellulare with participation of chorionic villi.

(3) The malignant, interstitial, hydatidiform moles and placental polypi.

The third variety he held to be quite distinct from the decidual tumours, being a sort of parasitic invasion by chorionic villi of the maternal tissues, which except for some inflammatory reaction remained passive. The second variety formed the bridge between the real decidual tumours and the pure malignant moles. In the former he held that the decidua cells were the essential malignant elements, while the chorionic elements which had been described in the cases of Gottschalk and Schmorl were adventitious.

The views of Sänger as to the pathology of the condition have proved to be erroneous in many respects, but to him belongs the great merit of focusing the attention of gynæcologists and pathologists on the disease, and of paving the way for a proper understanding of a condition, the practical importance of which has been indicated. Very soon it was proved that the tumour of which he may be said to be the discoverer, although not exactly common, was by no means a great rarity. Cases began to be reported in considerable numbers, many of them being old ones which had formerly been recorded under different names. Most of the cases were reported as deciduoma in the sense of Sänger, but divergent views also appeared. Gottschalk in 1894 repeated his view that the disease was one primarily of the fœtal tissues, being essentially a sarcoma of the chorion arising from Langhans's layer (regarded by him as of fœtal mesoblastic nature), and the stroma of the villi. Schmorl also regarded the participation of the fœtal tissues as essential to the tumour. Menge, on the other hand, in reporting two cases, took the view that they were sarcoma originating from the uterine muscle; and the committee of the London Obstetrical Society regarded the cases shown to them as rapidly growing sarcoma having no special characteristics. The opinion of Veit that deciduoma is carcinoma of the uterus modified by the superposition of pregnancy, though advanced later, may also be mentioned here.

In 1895 L. Fraenkel reported a case in which the growth consisted almost entirely of syncytium, and called it *syncytioma malignum*, or *carcinoma syncytiale*, because he regarded it as originating not from the decidua, but from the syncytium of the chorionic villi. He did not commit himself to an opinion as to the exact derivation of the syncytium. He also described the decidua-like infiltrating cells, but refrained from expressing a definite opinion as to their nature.

About the same time Marchand published the papers which brought order out of this chaos. According to his view this growth was composed of cells derived from both layers of the chorionic epithelium; it was therefore—accepting the then prevailing opinion that the syncytium was derived from the uterine epithelium, and the Langhans's layer from the fœtal epiblast—of combined maternal and fœtal origin. The difficulty of admitting that a tumour could be composed of both fœtal and maternal tissues was fully met by the conception of the chorionic epithelium as so specialised a structure, and the symbiosis of its two elements as so characteristic and essential a feature, that they were entitled to be considered together as one tissue. It was on this ground, as well as on the ground of their clinical history and histological structure, that Marchand regarded these growths as neither carcinoma nor sarcoma, but as tumours *sui generis*.

In the same year Whitridge Williams of Johns Hopkins Hospital independently recognised the connection of deciduoma malignum with the chorionic epithelium; although elements resembling Langhans's cells were observed, he considered the syncytium the important element. He was inclined to regard the latter as a derivative of the uterine epithelium, and he considered that the fœtal epiblastic nature of the former made it difficult to believe that the individual cells of the tumour could arise from it. He preferred to leave the question of their origin open.

The three last mentioned authors, then, at least agreed in referring the tumour to the chorionic epithelium. Since, however, the particular view which has prevailed is that of Marchand, the theory of origin from the chorionic epithelium has come to be generally associated with his name. Indeed, it is to Marchand that the credit is chiefly due of unravelling the confusion in which the subject had become involved, and of setting its pathology on a sure foundation of accurate observation and careful generalisation.

Marchand's theory of the nature and origin of the tumour was founded on a thorough investigation of the histology of the human placenta. He was able to trace a close resemblance, physiological and anatomical, between the chorionic epithelium and the tissues composing the tumour. The frequency with which hydatidiform disease of the chorion precedes deciduoma had been previously noted and had been held by some observers to be no accident. In the study of hydatidiform mole *in situ* within the cavity of the uterus, Marchand demonstrated that the generally accepted view of Virchow—that hydatidiform mole was a myxoma of the chorion—was erroneous. The stroma of normal villi consists of connective tissue, and in the young placenta it has the characters of embryonic connective, or mucous tissue. In the mole Marchand found that the œdematous condition of this tissue was due to degeneration and liquefaction. In the small vesicles (the early stage) there was much mucin, as was natural considering the nature of the tissue; but in the large vesicles there was very little, their contents being a watery fluid. There was no active proliferation of the connective tissue, which was poor in nuclei, and reduced to a thin rind lying beneath the epithelium. But there was excessive and irregular proliferation of both layers of the chorionic epithelium, and this Marchand regarded as the important change. Later observers have, in the main, agreed with him. The condition may vary somewhat, and in some cases there may be excessive proliferation as well as degeneration of the mesoblastic cores of the villi; but the important tissue with regard to tumour formation is the epithelium.

Besides setting the histology of the hydatidiform mole on a satisfactory basis, Marchand was able to trace an extremely close likeness between the hypertrophied epithelium in the mole, and the cell elements of deciduoma malignum. Not only were the cells which arose out of it the same in form, but they infiltrated the maternal tissues, and invaded the blood-vessels in a similar way. This he showed, further, was but an exaggeration of the conditions found in the young placenta around the attachments of the villi to the decidua. His conclusion was that no sharp line could be drawn histologically between the long-ago observed, but rare, malignant hydatidiform moles and deciduoma. In both diseases the active element is the chorionic epithelium, which takes on an excessive and aberrant growth after the manner of the epithelial structures in carcinoma. Unfortunately, he was also forced to consider it impossible to distinguish sharply between the epithelial proliferation in a simple mole and that in a malignant one: this conclusion still holds good.

According to the view of Marchand, then, the so-called deciduoma malignum or, as he called it in his monograph of 1898, *chorionepithelioma malignum*, may be regarded as a member of a series of diseased conditions of the chorionic epithelium, which shows many varieties, and a progression in degree of malignancy comparable with the progression from simple adenoma to malignant adenoma, or carcinoma.

Like other malignant tumours, it has its physiological prototype, the characters of which it reproduces in an aberrant and excessive manner. The young chorionic epithelium, or, to use the name which is now commonly applied to it, the trophoblast, is an extremely active tissue. Its structure is as characteristic as that of any other tissue of the human body; physiologically also, it is quite characteristic, discharging, as it does, the functions firstly of establishing a connection between the mother and the embryo, and, secondly, of maintaining it up to the time of birth. In respect of the former, it shows indeed a striking resemblance to a malignant tumour. As Hubert Peters observed in comparing the trophoblast of the earliest known human ovum with this tumour, "the young trophoblast has a striking power of growth, and in respect to its physiological relations in the early stages of the embedding of the ovum (destructive effects on the enclosing zone) does indeed manifest a destroying (malignant) action on maternal tissue." The villi of ova of slightly later date also show a very luxuriant growth of epithelium, which is quite normal; and even in the placenta of the third or fourth month villi may be found which show considerable masses of epithelium.

The actual diseased conditions related to this tissue (chorionic epithelium) may be accordingly classified as follows:—

(1) The simple hydatidiform or vesicular mole, which may be a dangerous disease apart from any actual malignancy.

(2) Malignant, perforating, or destructive hydatidiform moles, which differ little from the preceding in their structure, but in which there is a little more overgrowth of the epithelium, infiltration of the decidua, invasion of vessels, and establishment of metastatic growths. In the combination of essentially malignant epithelium with a stroma which may show growth but no malignancy, they may be compared with malignant papilloma.

(3) The pure chorionepithelioma, in which no trace of fœtal mesoblastic tissue is to be found.

(4) Connecting the two latter, tumours composed almost entirely of epithelial tissue, in which a few villi, either normal in appearance or more or less hydatidiform, are seen.

The tumours of the last class are the crucial ones, in which the whole of the tumour tissue in all its varied cell forms can be traced directly to its source. The relationship between the normal placenta, the moles, and the tumours had been worked out in a masterly manner by Marchand, but at that time a case of the last class was still required to demonstrate his conclusions.

In 1896 this gap was filled by the publications of Apfelstedt and Aschoff, and of Julius Neumann. In their papers several cases of characteristic deciduoma malignum were described, in which villi were present, and in which the origin from them of the tumour tissues was readily traceable. Their observations have been confirmed in many other cases. There is no clearer example of the tracing of a tumour to its physiological prototype. The controversy may be said to have been brought to an issue by Marchand in a second paper (1898), with the result that his view that deciduoma malignum and destructive (malignant) hydatidiform mole are diseases of the chorionic epithelium has taken a place among the established theories of pathology.

III. **Morbid Anatomy.**—The commonest site of the primary tumour is the wall of the uterus, but a considerable number of cases have been recorded in which that organ was quite sound and the primary tumour was situated elsewhere. The majority of the extra-uterine growths are situated in the vagina: one labial, several tubal, and two possibly ovarian cases have been recorded; in two of the cases the primary growth was interstitial (*i.e.* the growth was embedded in the uterine muscle, apart from and not in communication with the cavity), and in two cases the seat of it could not be precisely determined. In one of the latter a mass in the cavity of the right ventricle of the heart was supposed to be the primary tumour.

Commonly the uterus is enlarged to about the size of the organ at the end of the third month of pregnancy. There may be no sign of tumour externally: a few fibrous adhesions are commonly found; or, if deep ulceration or the formation of detached nodules or deep outrunners of the tumour has occurred, the surface of the organ may show rounded prominences in which a dull red colour shines through the normal greyish pink of the muscle. The uterine cavity is found to be enlarged as by the presence of an ovum. On incision the muscle contracts strongly, throwing into prominence the contained growth (Fig. 103). This is a rounded solid mass, of varying size, composed of old, firm, dull red blood-clot intersected by paler strands which consist of fibrin, or of uterine or tumour tissues in a more or less necrotic condition. Nearly the whole of the mass is of this nature, the active tumour-tissue forming only a thin layer between the clots and the uterine muscle.

The tumour presents a considerable resemblance to a fleshy mole, and the histories of many cases suggest that such masses may sometimes be expelled and regarded as fleshy moles. If the mass be putrid, as is commonly the case, it might be mistaken *in situ* for a sloughing myoma. The base of the tumour is broad, and covers a varying amount of the fundus and upper parts of the anterior and posterior walls of the cavity, corresponding to the common sites of the placenta. The lower part of the mass overhangs the base, filling the cavity, and there may be clear spaces at the sides up to the apertures of the Fallopian tubes.

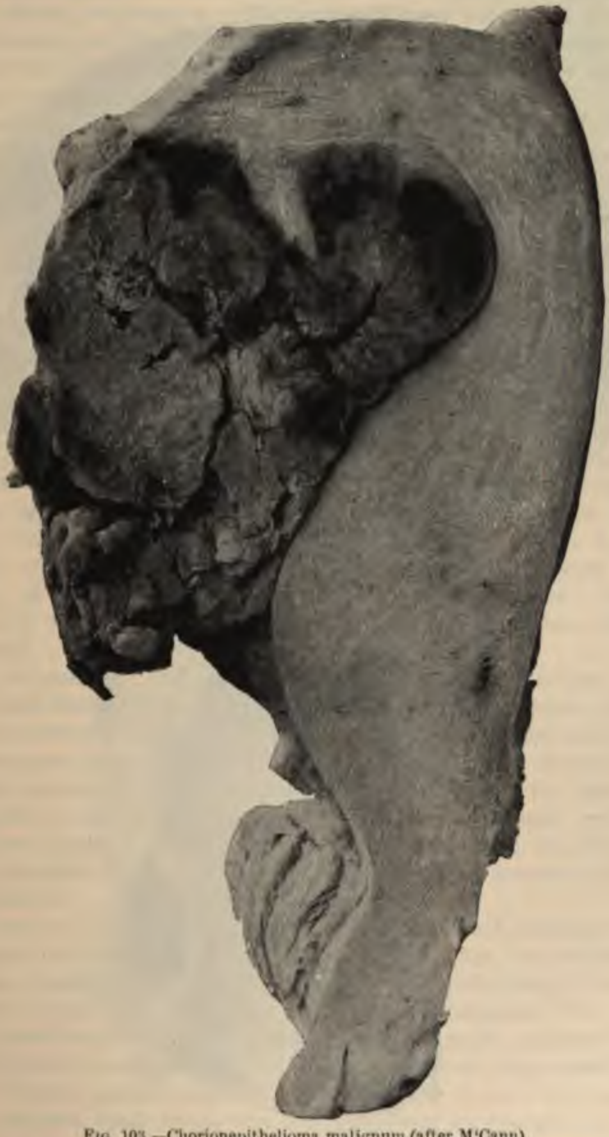


FIG. 103.—Chorionepithelioma malignum (after M'Cann).

The surface of the tumour, if small, may be covered for the most part by a thin layer of mucous membrane like the decidua reflexa. Near the uterine muscle the tumour presents in section a patchy red and white appearance, suggesting placental site. This zone consists of tumour masses, some actively growing, others more or less necrotic, mixed with areas of blood which simulate the uterine sinuses. The growing tumour for the most part lies between this layer and the uterine tissues, and may be

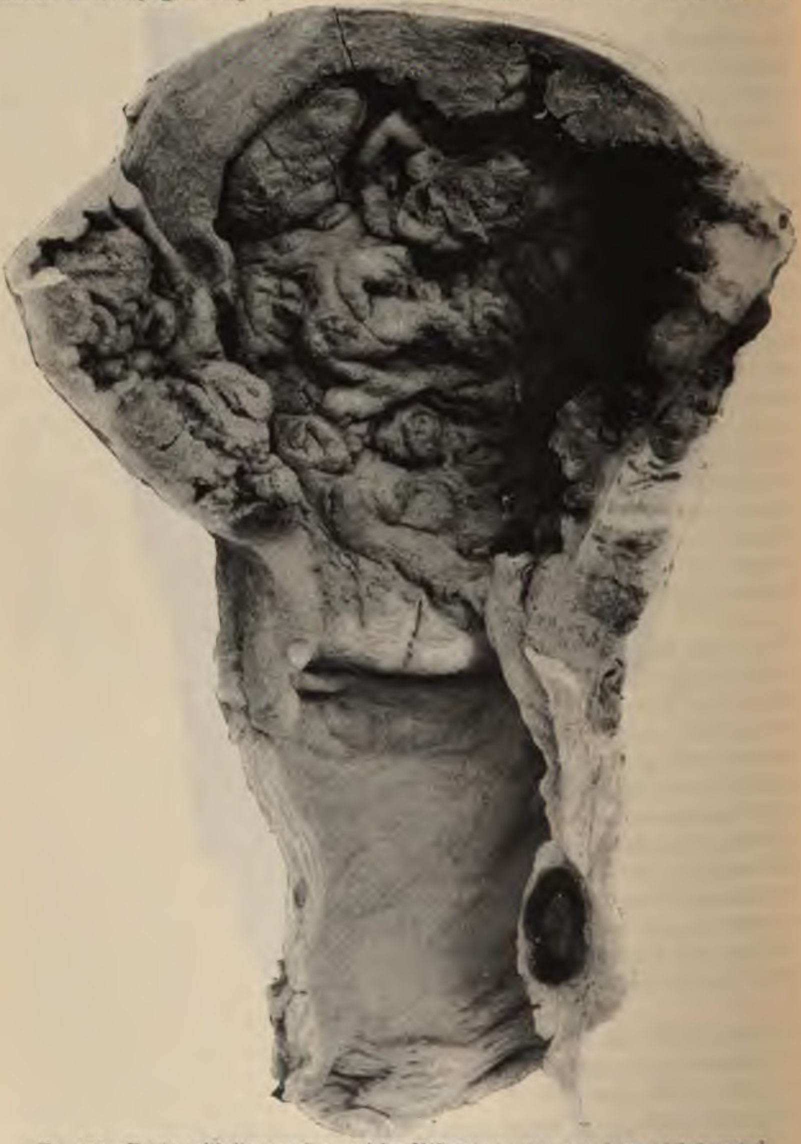


Fig. 104.—Chorionepithelioma malignum (after M'Cann), showing secondary nodule in vaginal wall (uterus and vagina removed post-mortem).

seen in places as a somewhat irregular layer of tissue one to two millimetres broad, which is just distinguishable from the muscle by its whiter and less shining appearance. Frequently there is very little of it, for the growth is an ulcer rather than a tumour. When the mole-like mass has been shed the appearance is that of an enlarged uterine cavity with ragged sloughing walls (see Fig. 104).

In some cases the tumour may be no larger than a hazel-nut, and in others it forms only a small ulcer burrowing deeply into the muscle, and containing some masses of tumour-tissue, and in some cases a few villi.

The extra-uterine and secondary tumours show a similar structure, appearing in section as rounded masses of firm blood-clot, at the edges of which a broken and often very scanty layer of pale tumour-tissue can be seen. The vaginal tumours are globular, projecting nodules of a deep purple colour, varying in size from a pea to a small apple, and they have been described as "thrombosed varices" or "hæmatomata." Possibly some of the recorded cases of hæmatoma of the vulva which refused to heal and finally cost the life of the patient were actually chorionepithelioma.

The commonest seat of secondary tumours is the vagina, and next the lungs, corresponding to the dissemination by the venous blood-stream. They have also been observed in nearly all the organs of the body in cases in which a general infection of the circulation has occurred. About a dozen cases of secondary tumour in the brain have been recorded, and in several of these the only symptoms were those of apoplexy, or the gradual development of coma or paralysis. Secondary infection of neighbouring lymphatic glands has been observed, but is exceptional.

The impossibility of drawing a sharp line of distinction between chorionepithelioma and malignant hydatidiform mole has been referred to. In about one-third of the recorded cases of chorionepithelioma the preceding pregnancy was a hydatidiform mole; but in the majority of the resulting tumours either the epithelial portion only of the placenta was represented, or only a few villi were present in the primary growth. In the true malignant moles the connective-tissue cores of the villi, as well as the epithelium, show excessive growth, but the destructive element is the epithelium.

In some of the malignant moles a vesicular mass was expelled from the uterus, but further growth of the same character occurred which behaved as a malignant tumour. In other cases perforation of the uterus was the first sign that a dangerous disease was in progress. The uterus in all these cases was found distended with vesicular mole, processes of which burrowed into the muscular wall along the venous sinuses, extending even into the blood-vessels beyond it, and destroying it to a varying extent. In some cases a fatal result was brought about by the primary growth, through rupture of the uterus or hæmorrhage, without metastasis having occurred. In other cases metastatic growths were formed; they were generally identical with those of chorionepithelioma, but in at least three cases they contained masses of vesicular mole. Several examples of primary vaginal tumour with sound uterus were also found to contain hydatidiform villi.

The cases in which the primary tumour is situated outside the uterine cavity, while the latter is quite healthy, fall into two categories. A number of them are connected with pregnancy in the Fallopian tube or ovary. With regard to the remainder, there is doubt as to whether they are (*a*) metastases from a uterine placenta showing malignant activity, which was subsequently completely thrown off; or (*b*) detached portions of a normal placenta which assumed the characters of malignant growths in their extra-uterine seat. It has been shown that portions of syncytium and even portions of villi may be detached into the circulation in normal pregnancies (*Verschleppung der chorionzotten*, Poten; *Deportation*, Veit), and these facts appear to us to offer the more probable explanation of these extra-uterine cases.

A third possible explanation of a few of these cases may be found in the remarkable fact that malignant tumours, identical in their gross and histological characters with chorionepithelioma, have been observed apart from pregnancy, and even in men. This was first recognised by Kanthack and Eden, and demonstrated to the London Obstetrical Society in 1896 in connection with the discussion on deciduoma malignum. The primary tumour was called a "sarcoma of the testis," with secondary nodules in various organs. This observation remained isolated and inexplicable until 1902, when Schlagenhaufer published a similar case, and advanced the view that the primary growth was a mixed tumour (teratoma or dermoid); and that the chorionepithelioma-like tissues, which alone manifested malignancy, represented the trophoblast (chorionic epithelium) of the included ovum, which, according to current theory, is the source of teratoma.

A number of cases of this kind have now been recorded, for the most part connected with the testis. Lubarsch described a chorionepithelioma occurring in a girl of thirteen years who had never menstruated: the tumour was attached to the uterus. Bock observed a "hydatidiform mole" which was expelled from the uterus of a girl of 12½ years who was undoubtedly a virgin. This growth, unfortunately, was not examined microscopically. In a dermoid of the ovary, L. Pick found a cyst containing simple vesicular mole. Lastly, in a case described by Ritchie, the tumour was a dermoid of the anterior mediastinum of a man, which was in part chorionepitheliomatous, and had given rise to extensive secondary chorionepitheliomatous nodules in the lungs and various other organs. A placenta has also been described by Maydl in connection with a teratoma (*fœtus inclusus*) of the abdomen, consisting of a well-formed trunk and limbs enclosed in an amnionic sac.

The nature of the chorionepithelioma-like growths unconnected with pregnancy is still under discussion, some holding that they arise from glandular epithelium in the teratoma; but whatever their nature, the specificity of the ordinary chorionepithelioma is not affected.

IV. **Histology.**—Much of the controversy as to the nature and lassification of chorionepithelioma has arisen from defects in our knowedge of its physiological prototype, the chorionic epithelium. This has ong been known to consist of two layers, and various opinions have een held as to their nature and origin. Langhans, in his classic descripion, regarded the syncytium as fœtal epiblast, and the inner layer, now alled by his name, as fœtal mesoblast. Another view which was widely eld is that already referred to in discussing the theory of Marchand. But by the work of many observers, of whom Hubrecht, von Spee, and Peters especially deserve mention, it has now been established that the horionic epithelium is entirely of fœtal origin, and that the human ovum ecomes attached to the uterus by embedding itself in maternal connective issue by means of a proliferation of its primitive epiblast. The following s an outline of what is held to be the process. The ovum, probably in n early stage of segmentation, settles on the surface of the uterine mucous membrane, destroys a minute area of epithelium, and embeds tself in the underlying connective tissues, which also undergo destruction o some extent. At first there is some hæmorrhage, and the aperture by which the ovum entered is closed by a cap of blood-clot. As segmentaion advances the ovum is differentiated into two layers of cells, an outer nd an inner. The inner, or hypoblast, remains comparatively small n amount; the outer layer, or epiblast, proliferates rapidly into a thick ayer of cells, which at one part becomes still thicker and projects inwards gainst the hypoblast. The greater part of the epiblast, in fact all except his knob of cells lying towards the centre of the ovum, takes no part whatever in the formation of the embryonic shield, but becomes specialised s an organ for the nutrition of the ovum. This thick layer of primitive piblastic cells Hubrecht named, on account of its nutritive function, the *rophoblast*, or trophic epiblast. In the early stages of development the rophoblastic portion of the ovum grows much more rapidly than the mbryonic portion, thus forming a relatively large nutritive organ which ncloses a very small embryonal rudiment.

Around the ovum destruction of the maternal tissues occurs to a onsiderable extent, the degenerated remains probably being used up by he trophoblast for its nourishment. Then a reaction in the maternal issues outside the zone of destruction sets in, and they begin to prolierate, developing into what is called in the human subject the decidua. An equilibrium becomes established between the trophoblast and the proiferating uterine tissues; union of fœtal and maternal tissues then takes lace; and where maternal blood-vessels have been opened the trophoblast ecomes hollowed out into a sponge-work of cavities containing maternal lood. This does not coagulate; on the contrary, the cavities take the lace of vessels—become, as it were, a part of the maternal circulation, nd a primitive placenta is thus completed. There has been no extenion of the maternal endothelium in the form of a lining into these avities. Like the maternal epithelium, the endothelium in contact with he trophoblast disappears, and its place is taken by fœtal cells. Later, with the growth of the embryonic rudiment and its differentiation into the three primitive layers, the fœtal mesoblast, bearing blood-vessels, enters into combination with the trophoblast; in this way villi are formed consisting of cores of fœtal mesoblast covered with trophoblast; the latter thus becomes the epithelium of the chorionic villi, the cavities in it becoming the intervillous spaces. Here, then, is a true placenta, the tissues of which are entirely fœtal, containing a circulation of maternal blood and a circulation of fœtal blood.

The trophoblast (as seen in the Peters and Siegenbeek v. Heukelom ova), and in the young (six to eight weeks) chorionic epithelium, presents two principal types of cells:—

(1) An inner single layer of cubical cells having clear protoplasm and round or oval vesicular nuclei of relatively large size, moderately rich in chromatin, and showing a well-marked intra-nuclear network and nucleolus; multiplication is by indirect division, and karyokinetic figures can usually be found in them. The protoplasm contains glycogen. This is known as Langhans's layer; the cells are spoken of as "individual cells," in contradistinction to the syncytium. They rest on the connective-tissue core, the line of junction often being a well-marked basement membrane.

(2) Enclosing the former, and separating it from the maternal blood in the intervillous spaces, is the syncytium, a layer of protoplasm in which no definite cell boundaries are recognisable. The protoplasm has an opaque appearance, and takes contrast stains such as eosin somewhat deeply. In specimens fixed with osmic acid it is commonly found to be loaded with finely divided fat. The nuclei are generally smaller than those of Langhans's layer, oval or more elongated in shape, solid and staining more deeply. The process by which the syncytium develops out of the individual cells of the primitive epiblast is not known.

The appearances, and especially the distinctness of the two layers, vary considerably, according to the age and state of preservation of the placenta and the character of the fixing agent used. Defective preservation tends to obscure the distinctness; also, about the third month Langhans's layer begins to atrophy, and in the latter half of pregnancy only the syncytial layer remains.

The syncytium frequently throws out buds, which may be detached from the main layer and lie free in the maternal blood as multinucleated giant cells; sometimes the syncytium forms merely a thin layer resembling endothelium. Here and there Langhans's layer spreads out into masses of considerable size. These occur in the intervillous spaces (forming the "cell knots"), but are best developed at the attachments of the villi to the decidua. At these points they form a layer several cells deep between the tip of the connective-tissue core and the tissue to which the villus is attached (Fig. 105). The cells composing these masses retain their usual characters, but both nucleus and cell body tend to be considerably increased in size. The syncytium does not enclose these cell masses, but divides on either side, and is applied to the surface of the decidua lying between the attachments of villi. In the young placenta there is commonly no mingling of the cells of Langhans's layer with the decidua, the two being separated from one another by a dense stratum of necrosed tissue mixed with fibrin—the *canalised fibrin layer*.

The cell knots often contain more or less fibrin or necrotic material, and the cells then tend to be enlarged and altered in character. Thus they may form masses of somewhat large cells, with very large nuclei, more or less embedded in fibrin, and presenting a superficial resemblance to decidua cells. They were formerly regarded as processes of decidua. Apparently these cells are for the most part derivatives of Langhans's layer, the modification being of the nature of hypertrophy, with more or less degeneration, the exact limits of the two processes being very difficult to determine. Masses of syncytium and cells of intermediate character may also be seen in the cell knots.

In the edge of the decidua and in the canalised fibrin layer, the hypertrophied cells may be found in small numbers. Large multinucleated masses identical with the buds of syncytium, are to be found in the decidua, and even deep in the muscle, in varying number (Fig. 105). These are generally held to be detached and infiltrating buds of syncytium, and are referred to as syncytial wandering cells. Infiltration of the maternal tissues by fœtal elements beyond the limited amount above indicated, should be regarded with suspicion.

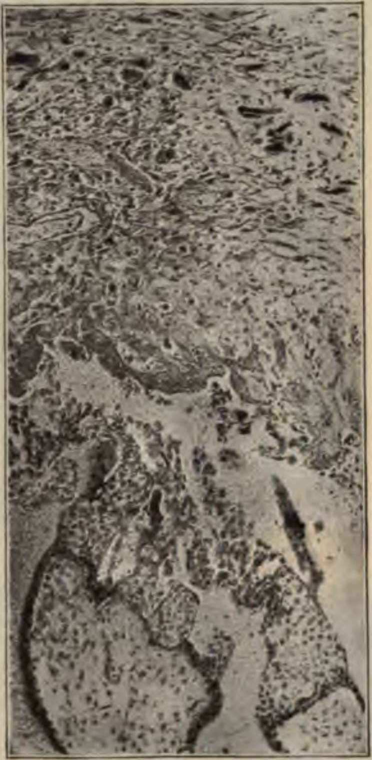


FIG. 105.—Decidua and villus (normal).

In its histology the tumour we are considering closely resembles the normal chorionic epithelium, but evidences of exaggerated activity and perverted growth are apparent. To the naked eye, as already mentioned, the tumour really consists of a thin layer between the mass of clot and the uterine muscle. With a low power it is found that outrunners of the tumour tissue burrow deeply into the muscle, especially along the tracks of the blood-vessels, loosening it out and pushing layers of it up into the body of the tumour. This may give rise to a somewhat alveolar arrangement (Fig. 106), but it is quite irregular and coarse, and totally different from the alveolar structure characteristic of carcinoma. The tumour does not contain connective-tissue stroma or blood-vessels of its own, nor does it convert the adjacent normal tissues into a stroma. Some of the detached nodules of tumour seen in sections (Fig. 106) are burrowing processes, others are actual metastatic growths in the uterine muscle.

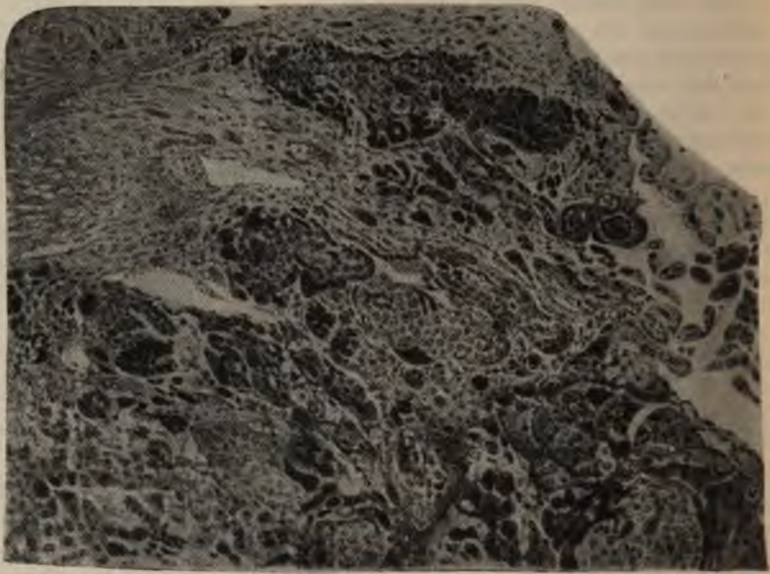


FIG. 106.—Section of tumour, low power.

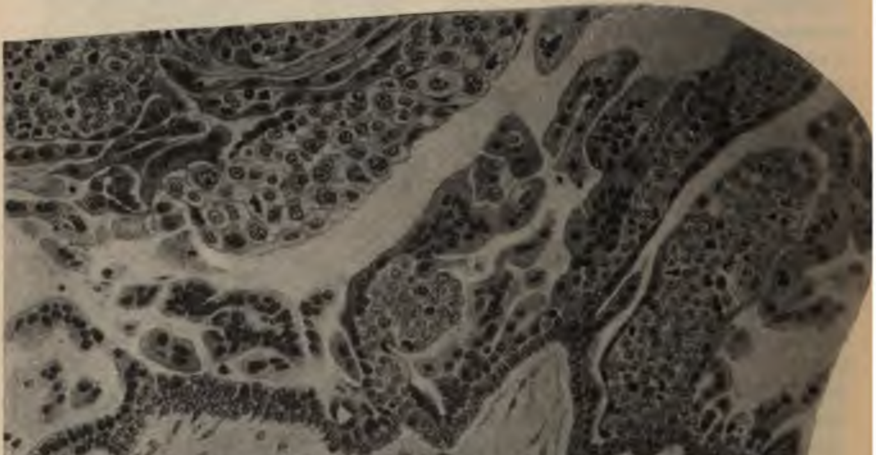


FIG. 107.—Section of tumour, high power.

Fig. 106 shows most of the types of cell formation under a low magnification. The darker masses represent the tumour, which in this place was infiltrating the uterine tissues, principally in large masses, giving rise to the irregular alveolar arrangement already referred to.

Figs. 107, 109, 110, illustrate under higher power the cell forms and mode of growth in the body of the growing tumour. In all of them it will be seen that there are two principal cell forms. Figs. 107 and 108 are taken from a section of Haultain's tumour. They show part of a villus, to the epithelial outgrowths of which the origin of all the cell forms in the tumour can be traced.

The structures which usually attract attention, and in their peculiar combination with the other cell forms mark the tumour as something different from the ordinary sarcoma or carcinoma, are the derivatives of the syncytium, which appear as large, multinucleated masses of protoplasm of various shapes and sizes—rounded or oval giant cells, long-drawn-out bands and whorls, or irregular sprawling masses. These are frequently riddled with vacuoles which may contain *fluid blood*, which frequently spin it out into meshworks of very fine threads (Fig. 110). The nuclei are generally small, oval, dense, and stain deeply and uniformly with the chromatin stain, therein corresponding with what is seen in the normal placenta; but not infrequently nuclei of other types are seen in the syncytium; especially there occur large, clear, and vesicular nuclei with a well-marked intranuclear network and one or more nucleoli, and the staining comparatively light. Karyokinetic figures are absent, and the protoplasm shows the usual opaque character and strong affinity for eosin and other plasma stains. Masses undergoing degenerative changes generally stain still more deeply, and their nuclei become small,

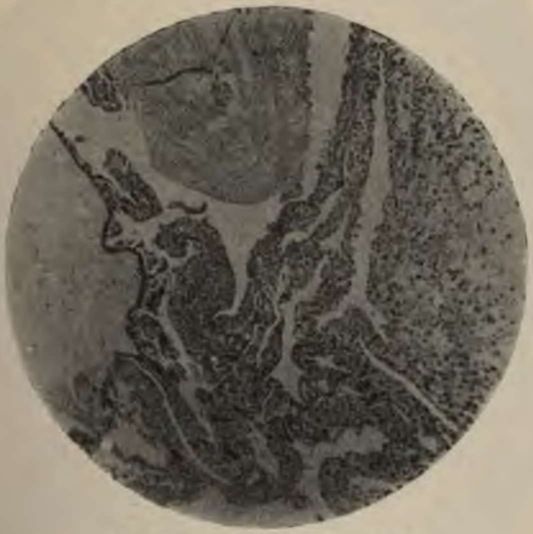


FIG. 108.—Section of tumour, with villus.

shrunken, indented, and stain deeply. Such cells are frequently loaded with fat globules. Some of the syncytial masses infiltrating the muscle resemble hypertrophied muscle fibres, but are distinguishable by their different staining reaction and the absence of longitudinal fibrillation.

The cells derived from Langhans's layer usually form masses of some size intimately united with the syncytium. The regular relation which is seen on the villi, where the syncytium forms a thin layer enclosing the other layer of cells, may also be observed in the tumour, but generally the relation between the two is irregular; it is an exaggeration of what is seen in the cell knots and at the attachments of villi to the decidua. Where the tumour is in contact with the maternal tissues, the syncytium, just as in the placenta, appears at the sides of the cell masses, and the individual cells of Langhans's layer are seen in actual contact with muscle or whatever the tissue may be, and even to some extent infiltrating it: there is no protecting fibrin layer between the tumour and the maternal tissues such as occurs in the placenta. The syncytium may form a mere endothelium-like edge, or it may be a broad border to the cell masses, and may also send in irregular processes among the individual cells. Remains of connective tissue as ragged shreds amidst the tumour cells are frequently to be seen.

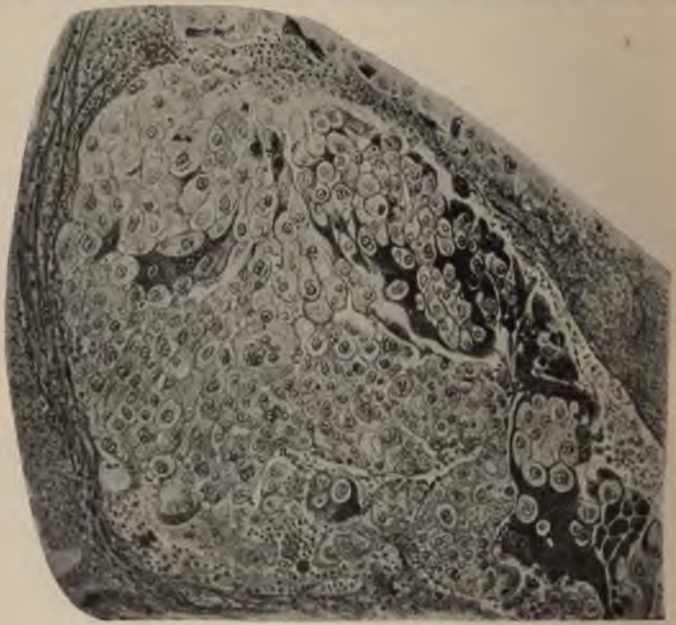


FIG. 109.—Derivatives of Langhans's cells.

The derivatives of Langhans's layer show the same characters as in the placenta. They form irregular masses like those at the tips of the villi. Fig. 107 shows at once their origin, their characters, and the modifications which they undergo. In the youngest stage they are relatively small, polyhedral in shape, and closely packed together. The older cells are larger and clearer, and their boundaries are more easily made out; the manner in which they are packed together is typical of epithelial cells. The nuclei are larger; the cell bodies are relatively still more enlarged. The karyokinetic figures may be perfectly regular, but many of them are excessively irregular. In certain fields they may be very numerous. Round about the cell masses there is usually a certain amount of blood, which may be clotted or fluid, and which usually contains large numbers of polymorpho-nuclear leucocytes. These will serve as a measure by which the general large size of the cellular elements composing the tumour may be estimated (Figs. 109 and 110).

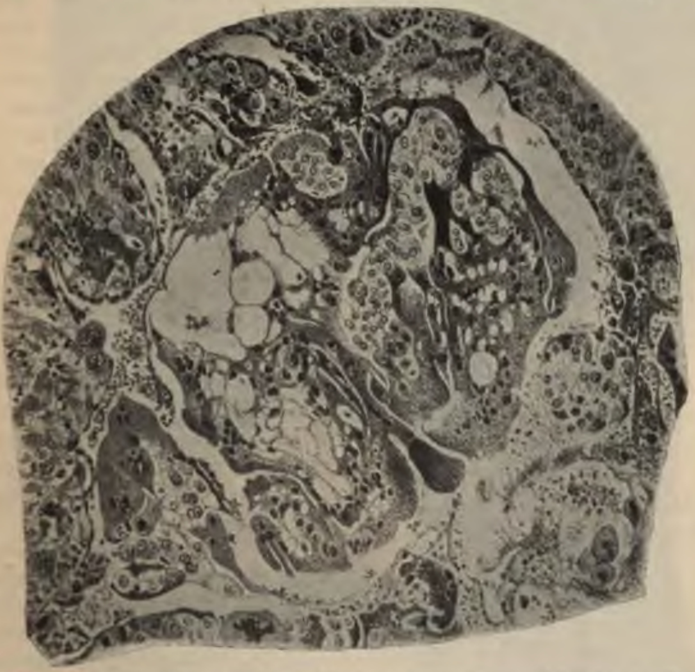


FIG. 110.—Section of tumour showing blood-spaces, syncytium, and Langhans's cells.

There are also cells of very varied shapes and sizes which do not conform to either of the types already mentioned. They are large cells, and contain from one or two to ten or more nuclei. In some tumours they form a large part of the cell masses, and they are also seen, especially where the maternal tissues are being infiltrated by the tumour, either embedded in the eroded connective tissues or lying under the endothelium of blood-vessels (Fig. 111). Many of them appear to be overgrown

Langhans's layer cells, others are identical with the syncytial wandering cells, and others present characters intermediate between the two. In a section of tumour containing villi they can all be traced to the chorionic epithelium. Their relationship to the maternal tissues is an exaggeration of what can be found in the normal placenta; but the variety of cell forms and the degree of infiltration are far greater. In hydatidiform moles which have been examined *in situ*, however, the same variety of cell forms and greater well-marked infiltration are found, so that here again no sharp line can be drawn between the simple mole and the tumour.

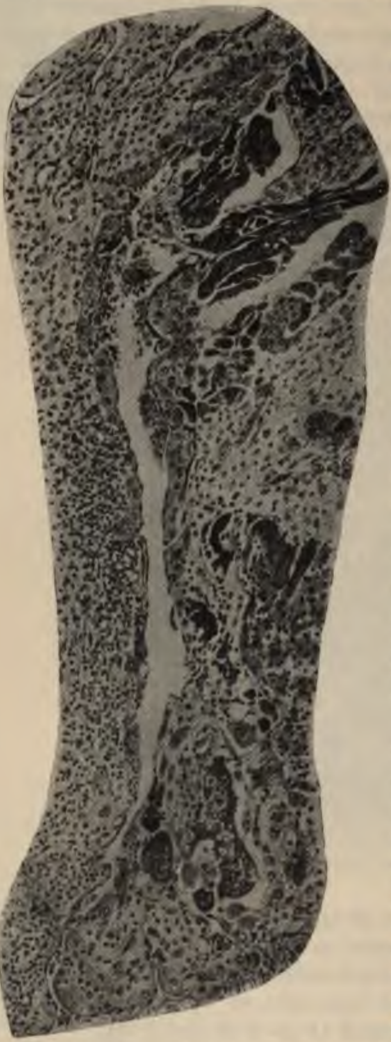


FIG. 111.—Blood-vessel with tumour cells beneath the endothelium.

The tissues adjacent to the tumour frequently show a certain amount of inflammatory reaction, and may have the characters of granulation tissue. In parts where this has occurred the edge of the tumour has quite the appearance of an infiltrating sarcoma, but the character of the tissue changes at once when followed back to the cell masses.

The degenerative changes which occur in the tumour in consequence of hæmorrhage into its tissues are of practical importance, because in curetting, whether for therapeutic or for diagnostic purposes, the material which is most likely to be scraped out is the old blood-clot and degenerated tumour tissue which forms so great a part of the growth. The principal changes of this nature in the individual cells are crushing together of cells producing an irregular spindle shape, retraction of the cytoplasm from the nucleus, shrinking of the nucleus, and loss of the distinct intranuclear structure. In other cases the cells may become loosened out. The division into two layers becomes lost; the syncytium preserves its features longer; therefore if there is any living tissue found among the fibrin it will probably be a mass of very large cells of very various shapes and sizes (Fig. 112). The appearance at least suggests malignant growth of some sort, if not definitely chorionepithelioma. Again a mass may be found in which the two usual constituents are present, but the cells are all shrivelled, and the nuclei small and dense; in such a case the presence of a large multinucleated syncytium with its opaque red protoplasm, or of a syncytial border to the mass, is the best guide to the nature of the tumour.

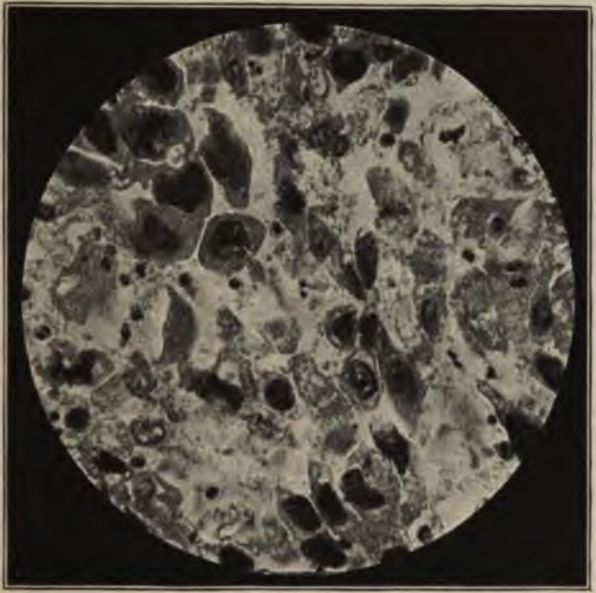
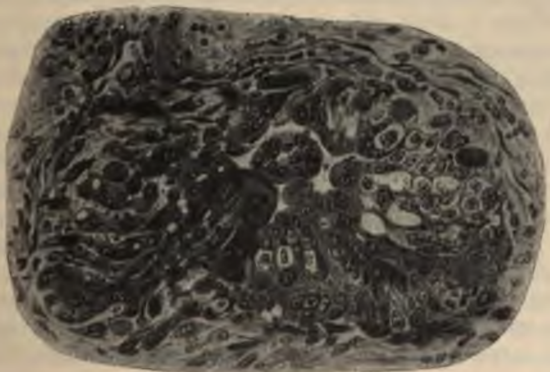


FIG. 112.—Chorionepithelioma : large irregular cells.



113.—Process of tumour extending along wall of blood-vessel.

V. **Microscopical Diagnosis.**—The microscopical recognition of the tumour when removed with the uterus is very easy; there is no tumour with which any one of moderate histological experience can confuse it; but the diagnosis from curettings is a very different matter. Cases of carcinoma of the uterus occur occasionally, the epithelial masses of which resemble chorionepithelioma in containing individual cells and syncytial masses; but their mode of growth in an alveolar stroma is totally different from that of chorionepithelioma. The impossibility of drawing a sharp histological distinction between the villi of simple hydatidiform mole and those of chorionepithelioma or malignant mole, has been insisted on. Notwithstanding this fallacy, one can hardly overestimate the value of the histological test in these cases, for now that the fallacy is known, it should not give rise to much trouble. Still, the rule that diagnosis should not be allowed to rest on microscopical evidence alone does not apply less strongly to chorionepithelioma than to other tumours. There seems to be little danger of this occurring, for only too frequently, even in the history of recent cases, the statement is made that portions of "retained placenta" were removed and thrown away without being submitted to microscopic examination. Then after a loss of weeks or months, when the clinical signs have become so urgent that hardly a doubt remains, the diagnosis is established by this means, but too late. Krebs, for example, points out that four months were probably lost in the case which he described, through examination of the curettings being limited to the identification of them in the fresh state as placental tissue. In the case of Austerlitz, the warning was actually given, but was disregarded, while in the case of Graefe radical operation was delayed because villi were present.

As a matter of routine, in all cases with suspicious clinical history, the whole of the curettings should be submitted to the pathologist *in proper condition*. Where a mass of curettings is available, it should usually be possible by separating them in saline solution to bring to light material which will give information that, in conjunction with the clinical signs, would be enough for practical purposes. When masses of tissue such as those figured (Fig. 110) are found apart from villi, more than two or three weeks after a confinement, the diagnosis of chorionepithelioma may be given with confidence. The diagnosis from discovery of degenerated masses of tumour is discussed on p. 400. Where villi are present the case is very different. The possibility of malignant mole must not be forgotten, but greater weight should be given to the clinical signs than to the microscopical evidence. Statistics show that the cases following hydatidiform mole are rather less malignant than those following abortion, or pregnancy carried to term; these are the cases in which villi are most commonly found in curettings. Delay, with careful watching of the patient, will generally prove more satisfactory than precipitate operation in any case in which villi are found.

The precise amount and character of epithelial overgrowth that would warrant a diagnosis of malignancy cannot be laid down. Complete recovery after simple curetting has been seen in cases similar to that shown in Fig. 109, which is taken from the case of Haultain. In shreds of uterine tissue removed by the curette, especially after hydatidiform mole pregnancy, a certain number of the so-called syncytial wandering cells may be found, and there is evidence that they may persist for several weeks after the termination of the pregnancy. They do not warrant a diagnosis of chorionepithelioma, but such cases ought to be kept under observation. "Neumann's cells"—large cells like syncytial wandering cells which are found in the stroma of the villi, usually just under the epithelium—were by their discoverer supposed to occur only in malignant cases, but this has been entirely disproved.

On account of the friability of the tissues, curettings should always be cut into sections by one of the methods in which they are carefully embedded; and paraffin is preferable to celloidin, because it is much more rapid, and because the characters of the cells are more delicately displayed by this process.

VI. **Ætiology.**—In regard to causation no more is known of chorionepithelioma than of any other malignant tumour. In spite of the anatomical and physiological peculiarities of the normal tissue, the relations of the tumour of the chorionic epithelium to the general problem are not different from those of malignant tumours of the other tissues of the body. In the trophoblast as known to us, and in the epithelium of villi of an age corresponding to those that have been found in tumours, the karyokinetic figures are of the ordinary somatic type. In chorionepithelioma similar figures are found, but the majority of the mitoses are strikingly asymmetrical or irregular. Resemblances to the heterotypical mitosis characteristic of the maturation stage in the reproductive cycle (and of "gametogenic" tissues) are undoubtedly presented; but, generally, the terms hyperchromatism and hypochromatism of Hansemann would more appropriately describe the appearances.

Diminished resisting power on the part of the maternal tissues, due to frequent child-bearing or to local disease; absence or imperfect formation of the fibrin layer; or, on the other hand, some cause inherent in the ovum, have all been suggested as reasons for the ungoverned proliferation of the chorionic epithelium in the tumours; but all lack a sound scientific basis of fact. Little attention has been paid to the presence of parasite-like cell-inclusions, but they have been seen.

Attention has recently been directed to the occurrence in a certain proportion of cases of cystic disease of one or both ovaries in association with both hydatidiform mole and chorionepithelioma, and, further, to the fact that cysts arising in the corpus luteum, and attended with the excessive production of lutein cells and their distribution through the ovarian stroma, form the special features of the ovarian disease in these cases. From these facts the suggestion has been made by L. Fraenkel, and supported by Pick, Jaffé, Lockyer, and others, that the cause of both hydatidiform mole and chorionepithelioma may be found in perverted ovarian activity, as indicated by excessive production of, and pathological changes in, lutein tissue. As it is only within the last two years that attention has been directed to this point, sufficient evidence has not yet been accumulated to allow of an estimation of the value of this suggestion. In the majority of cases of chorionepithelioma the ovaries were only examined casually and by the naked eye; therefore we do not know whether the cysts so frequently described as being present were lutein cysts or not. No doubt many cases will now be re-examined, and a good deal of light ought to be speedily thrown upon the question. In the meantime it may be said that inasmuch as chorionepithelioma, hydatidiform mole, and cysts of the corpus luteum are all rare conditions, their occurrence in direct association must be something more than accidental when observed in a considerable proportion of cases. If the frequent association of two rare conditions indicates identity in causation, then the frequent association of three rare conditions enormously multiplies the odds against the association being accidental in the case of any or all of them.

VII. **Incidence.**—Chorionepithelioma is essentially a disease of fertile women, but we do not at present know whether race, climate, or social conditions exert any influence upon its occurrence. It may occur at any age within the limits of possible pregnancy, a case having been recorded at the age of 17 years and one at 55 years. In the series of 189 cases tabulated by Teacher in 1903, the average age was 33 years; 67 per cent of the total number of cases occurred between the ages of 20 and 40; but there were 6 cases below 20 and 9 cases over 50 years. Considering the infrequency of pregnancy after the age of 50, the latter figure is very striking, and appears to indicate an increased tendency to the occurrence of this disease at the close of the fertile period of life. In 4 of these 9 cases the menopause was supposed to have been passed before the onset of the disease. It must, however, be borne in mind that hydatidiform mole, which is a frequent precursor of chorionepithelioma, is also more prevalent towards the extremes than in the middle of the fertile period, and may thus influence the incidence of this disease in women of 50 years and over.

The age incidence is, however, largely influenced by another factor, viz. fertility. Nothing is more striking, as Teacher's statistics clearly show, than the rise in frequency of the disease *pari passu* with the degree of fertility. In 156 of his series of 189 cases in which the necessary data are available, we find the disease arising:—

(1) In connection with the 1st pregnancy in 4·77 per cent.
(2) After 1 preceding pregnancy in 15·37 per cent.
(3) „ 2 or 3 preceding pregnancies in 28·24 per cent.
(4) „ 5 or more preceding pregnancies in 37·8 per cent.

The average number of pregnancies, estimated in a sufficient series of fertile women, is less than 4; therefore those in whom 5 or more have occurred represent a decided minority, and the large proportion of cases of chorionepithelioma occurring in women of this high degree of fertility must represent an increased liability in them to this disease. It is worth while in this connection to note that in the 9 cases in which the disease occurred over the age of 50, the average number of pregnancies was a fraction over 10; it is therefore probable that the high degree of fertility found in those women is a more important predisposing factor than the age. Frequent child-bearing, as we know, may predispose to the occurrence of malignant disease in the cervix, but it is impossible to speculate profitably upon the manner in which it may influence the occurrence of the disease under consideration.

Next to the incidence of this disease with regard to age and fertility, the most important points to be noticed are its *relation to the immediately preceding pregnancy*, and the *nature of that pregnancy*. With regard to the former, the immediate clinical connection is in some instances perfectly clear. A small number of cases have been recorded in which the disease has manifested itself during pregnancy. This is well illustrated by one of the cases of Pick, in which a vaginal primary nodule formed, and was discovered at the fourth month of pregnancy. It was diagnosed as chorionepithelioma from microscopic examination after removal; but the patient refused to submit to hysterectomy, and spontaneously aborted a hydatidiform mole three days later. There was no uterine tumour, and the patient was known to be well four years later, having borne a child in the interval. When the primary growth is uterine it is, of course, very difficult to demonstrate its onset during pregnancy, for it is practically impossible to detect it until after the pregnancy has come to an end. But Veit and other observers strongly defend the view that in some cases the growth may be present in the uterus at the time that conception occurs.

In a much larger number of cases the symptoms characteristic of the disease have followed immediately upon the termination of pregnancy, either by abortion or by labour at or near term, without any recognisable clinical interval. Cases in which the disease followed a first pregnancy are particularly interesting in this respect, and among the sixteen primiparæ in Teacher's list this form of onset was found in twelve, *i.e.* in three-fourths of the total number.

In the majority of cases, however, a definite interval is apparent between the termination of the last evident pregnancy and the onset of the disease. In many cases some difficulty arises at this point, owing to the nature of the initial symptoms. A short period of amenorrhœa is followed by hæmorrhage, and frequently by the discharge of clots or "fleshy pieces"; and with recurrence of the hæmorrhage the characteristic symptoms of the disease in the early stage are developed. No direct evidence of abortion can be obtained, and the question arises whether the preliminary period of amenorrhœa indicates the occurrence of conception, or whether it is to be regarded as the earliest symptom of the disease itself. This difficulty of demonstrating the immediate dependence of chorionepithelioma upon pregnancy in such a large number of cases, was a point which greatly influenced the earlier critics of the theory of Marchand; but as that theory now rests firmly upon direct histological demonstration, such clinical difficulties as these are unimportant. In a smaller number of cases (43 in Teacher's list) a definite interval of freedom from symptoms, varying from 1 month to over 1 year, intervened between the termination of the last evident pregnancy and the clinical onset of the disease. Eight cases in all have been recorded in which there was a clear interval of more than 12 months, the longest being as much as 3¾ years; and in most of these the menstrual function was regular and normal in the interval. There is no evidence that the degree of malignancy bears any relation to the intimacy of the clinical association with pregnancy. It may therefore be said that in respect of its clinical relation to pregnancy three types may be distinguished:—

(1) That in which the disease develops during pregnancy.

(2) That in which the disease develops after a definite interval of several months to several years.

(3) That in which the clinical relation to pregnancy is obscure.

The *nature* of the pregnancy immediately preceding the occurrence of the disease is a point of great interest and importance, and has been already alluded to. In Teacher's series of 189 cases we find:—

After labour at or about term . .	49 cases.
„ abortion	58 „
„ hydatidiform mole . .	74 „
„ extra-uterine gestation . .	7 „

In other words, in 26 per cent only was the immediately preceding pregnancy normal; in the remaining 74 per cent (*i.e.* in nearly three-fourths) the pregnancy was abnormal. Of these abnormalities the most frequent is the hydatidiform mole, and the direct histological proof has already been set forth of the origin of the disease from the elements of this form of abnormal ovum. Before this histological evidence was forthcoming, observers had been led to surmise the existence of such a relation between these two conditions; for, as both are very infrequent, their occurrence in direct sequence in such a large proportion of cases could not be fairly attributed to coincidence.

With regard to the relation of chorionepithelioma to an immediately preceding abortion, the statistics may be misleading in one respect; for whenever a short period of amenorrhœa immediately preceded the onset of the symptoms of the disease, this has been accepted as evidence of abortion, even when no other evidence was forthcoming. Another explanation of these cases is, however, possible, viz. that in some instances irregularity of the menstrual function in the direction of amenorrhœa may be the first symptom of the disease. It may be objected that in no other form of malignant disease of the uterus is amenorrhœa observed; but Brennecke has shown that it may occur as an early symptom of some forms of endometritis, and no surprise need be felt if the symptoms to which chorionepithelioma gives rise should prove to be in some respects atypical of other forms of malignant disease of the uterus.

In all cases recorded as associated with tubal pregnancy the primary growth occurred in what was taken to be the gestation sac. It is by no means certain, however, that all of them really arose in a tubal gestation, for in no single instance was a fœtus or a chorionic villus found. It may be that some were instances of the occurrence of the primary growth outside the uterus, in the Fallopian tube. In two of the recorded cases there had been no pregnancy previous to the occurrence of the disease, nor was utero-gestation associated with it; there need therefore be no hesitation in accepting the view that the disease arose in a tubal gestation sac in these cases. It is worthy of note that six out of the seven cases of this kind in Teacher's list died, and even up to the time of writing we know of no other instance which has been reported as surviving when the disease arises in this situation, although several additional ones have been reported as terminating fatally. In all cases of recorded autopsy in this variety of the disease a particularly wide dissemination of metastatic growths has been noted, including lungs, brain, spleen, and kidney.

VIII. **Clinical Features.**—(*a*) *Signs and Symptoms.*—Apart from the possibility that amenorrhœa may occur in the initial stages, the earliest symptom is hæmorrhage. This hæmorrhage is severe, sometimes continuous with exacerbations, sometimes recurrent with distinct intervals. Not infrequently a history is obtained of the passage of "shreds" or "pieces." The bleeding is not accompanied by much pain, and the patient frequently attaches little importance to it, and may allow it to continue for many months before seeking advice. She may remain fairly strong and well nourished for a considerable period, or other symptoms may supervene which lead her to obtain medical assistance.

Anæmia, expressed by the patient as feebleness, soon appears, and often becomes profound, constituting the most striking feature of her condition. Wasting is uncommon in the early course of the disease, and has only been noted in the most virulent varieties. Another train of symptoms soon appears, however, due to the marked tendency which the new growth always shows to undergo necrosis. A foul vaginal discharge is noted, there is pyrexia of irregular course, and the patient grows rapidly ill and emaciated. In other words, symptoms of septic infection appear, due to decomposition of the tumour tissues. This marked liability to undergo necrotic changes is no doubt mainly due to the absence of well-formed vessels in the new growth and to the extensive occurrence of interstitial hæmorrhages. To this must be added the diminished powers of physiological resistance to infection resulting from depletion by hæmorrhage. Usually the fever is moderate, from 99·5° F. to 102° F., but occasionally rigors and other evidences of acute septic infection are met with.

In rapidly advancing cases hæmoptysis has been noted as occurring comparatively early; it usually indicates the presence of pulmonary metastases. Taken in conjunction with fever, emaciation, and anæmia, it is not surprising that such cases have been diagnosed as pulmonary phthisis. More rarely cerebral symptoms (convulsions, hemiplegia) have been the first to attract serious notice; such symptoms are due to cerebral metastases, and of course indicate a rapidly approaching fatal termination. Hæmaturia from extension to the bladder may also be met with, but is rare.

On physical examination the condition of the uterus first attracts attention. Where the primary growth does not occur in the uterus, and in rare instances where it does, this organ shows no change on physical examination. In the great majority of cases it is more or less enlarged: it may be merely "bulky," or it may be large enough to reach to a point half-way between the pubes and the umbilicus. It is smooth in outline, except in advanced cases. The condition of the cervix varies in a striking manner: it may be patulous, allowing the finger to be introduced into the uterine cavity, when a friable, easily bleeding mass of tissue will be detected in some part of the uterine wall; more rarely it is closed, and no indication of the nature of the uterine contents can be obtained. The frequency with which cystic enlargement of the ovaries has been found has been already mentioned.

The physical examination may reveal the presence of the primary growth on the labium, on the vaginal wall, or on the lips of the portio vaginalis. When accessible in this way to visual examination it appears as a soft, deep purple, "plum-coloured" nodule, or it may be several nodules, covered with intact mucous membrane, but liable to bleed with alarming freedom if roughly handled. Some of the tubal cases have been taken on clinical examination for ordinary instances of tubal gestation; in others the presence of a swelling at one side of and closely attached to the uterus has been detected, the nature of which could of course only be surmised. In one of these there was a vaginal metastasis.

Where metastases have formed in the lung, giving rise to hæmoptysis, irregular signs of consolidation or pleural effusion have been found in varying positions.

(*b*) *Diagnosis.*—It is obvious that during the early stages chorion-epithelioma presents nothing that is characteristic either in symptoms or in physical changes, and in point of fact it cannot be diagnosed without the aid of the microscope. The conditions just detailed can only be regarded as calling clearly for exploratory measures in order to enable a diagnosis to be arrived at. Recurrent hæmorrhage in association with recent pregnancy, especially in women of unusual fertility, and, above all, after hydatidiform mole abortion, must be regarded as an indication for exploration of the cavity of the uterus; and it is much to be regretted that in the minds of women of the poorer classes this symptom carries with it so little significance.

The uterine cavity must then be carefully explored, its contents removed *in toto*, and the whole carefully preserved and sent immediately to the microscopist. In a large number of cases the tissue removed has been pronounced on simple inspection to be "placental remains," and has not been microscoped; even when the symptoms have recurred and a second evacuation of the uterus has been practised, no microscopic examination has been made. It has already been pointed out that even the microscopic appearances may at times be inconclusive, but the aid of the microscope should invariably be obtained whenever broken-down tissue is found in the uterus under such circumstances as we are now considering.

Chorionepithelioma beginning in a tubal gestation defies clinical means of diagnosis. When the primary growth is extra-uterine but accessible, as in the vagina, the diagnostic process is simpler, and consists merely in removing the new growth and obtaining a microscopic report upon it. The importance of such cases is usually at once appreciated, for they are not likely to be mistaken for a frequent and non-formidable condition such as incomplete abortion, as may be the case when the primary growth is uterine.

Differential Diagnosis.—The risk of regarding cases of chorionepithelioma of the uterus as cases of sapræmia due to retained products of conception, must ever be borne in mind. Hæmorrhage, unless profuse, followed by fever and an offensive discharge, occurring after pregnancy and associated with an enlarged uterus containing masses of broken-down tissue, forms a clinical picture suggestive of puerperal sapræmia with retained products of conception. A diagnosis of sapræmia following hydatidiform mole pregnancy should be always regarded with the greatest suspicion, for it is quite probable that the condition will turn out to be chorionepithelioma. Owing to its soft and spongy nature, the new growth is readily removed with the curette, leaving the uterine wall, as felt by the examining finger, smooth and uniform. This will appear to confirm the view that the tissue consists not of new growth but of placental remains, for if it had been the former, one would expect inequalities or excavations to be left in the uterine walls. A knowledge of this peculiarity of chorionepithelioma should serve to avoid the fallacy of this conclusion. The effect of clearing out the uterus upon the course of the disease also provides a further point of distinction between these two conditions. In the case of chorionepithelioma well-marked improvement follows, the hæmorrhage may cease, and the patient's general condition is benefited. But this improvement is only temporary; recurrence of the hæmorrhage within a few days or weeks will occur, and if the uterine cavity be again explored, large quantities of soft tissue will be found, although the uterus was left empty and with smooth walls after the first operation. This rapid re-formation (in two to four weeks) of the tissue débris is characteristic of the disease, and in the opinion of Veit serves to distinguish it from septic retained products of conception, even without the aid of the microscope. But whenever possible the diagnosis should be established after the first operation, and without waiting for the reproduction of the uterine growth, otherwise valuable time will be lost before the necessary radical operation is performed. In one or two cases it is recorded that after curetting severe rigors occurred, and the patient succumbed from septicæmia, the autopsy alone revealing the presence of chorionepithelioma. In such cases, where sepsis and malignant tumour are combined, it is clear that clinical diagnosis must present great difficulty.

(*c*) *General Course and Termination.*—No variety of malignant new growth offers greater variation in malignancy than chorionepithelioma. Cases of extreme virulence may be met with in which death quickly occurs, from widely distributed metastases, even when radical operation is performed after a very short interval—varying from a few days to one month—has elapsed since the onset of the symptoms. Further, two or three cases of death from hæmorrhage following spontaneous perforation of the uterus from chorionepithelioma, arising in malignant hydatidiform mole, have been recorded, where no previous symptoms except hæmorrhage and rapid increase in size of the uterus were noted. On the other hand, recovery has been recorded after a radical operation performed when fifteen months and even eighteen months had elapsed since the onset of the symptoms, the patient remaining free from signs of recurrence for several months afterwards. Many examples intermediate in virulence might be quoted; but the reader who is interested in this point should refer to the tables of Teacher. Another point of great interest which has been established is that in some cases radical operation performed after the formation of metastatic growths may be followed by complete recovery and disappearance of the metastases. Chorionepithelioma is the first example of a definitely malignant growth in which this interesting occurrence has been demonstrated. The conclusive proof is to be found in the case of vaginal metastases, the spontaneous disappearance of which after removal of the uterus has been noted by Neumann and several other reliable observers: in one such case the patient was known to be well and free from recurrence nineteen months after the operation. In several cases the diagnosis of metastasis has rested upon the fact that hæmoptysis had appeared, which soon ceased after the operation; and in some others complete removal of the growth was found during operation to be impracticable, and a portion was left behind, which, however, underwent no further development afterwards, and was presumed to have disappeared spontaneously. The latter are not true instances of metastasis, but the principle involved is the same. It is believed that this disappearance of metastases is brought about by hæmorrhage, which destroys them.

An extraordinary case remains to be mentioned in which both a primary uterine and a secondary vaginal growth were present; the uterus was curetted and perforated during the operation, and the vaginal nodule was removed. The patient refused radical operation, yet she made a complete recovery, and normal menstruation was established three months afterwards; the patient being known to be well ten months later. This case was recorded by von Fleischmann, and more recently a parallel case has been reported by Hörmann.

It is scarcely possible to throw any light upon the causes of this remarkable variation in virulence. The situation of the primary growth is an important prognostic factor; for while, as has been mentioned, the primarily tubal cases have all run a fatal course, the primarily vaginal cases have proved to be much more benign than the average. There is an obvious fallacy underlying this distinction, however, for vaginal growths are more likely to attract early attention, and more readily diagnosed when noticed; for both these reasons they are more likely to be promptly removed than the tubal growths, the nature of which cannot be diagnosed before removal from the body. This may very probably explain the relatively benign character manifested by many of the former.

The histological characters also afford but little aid in this respect. It is believed that cases in which chorionic villi are found in the tumour are unusually benign, but this still requires confirmation. The evidence that the cases following hydatidiform mole are less virulent than others is fairly conclusive, but, on the other hand, the perforating form of hydatidiform mole appears to be extremely virulent. There is no evidence that cases following normal pregnancy at term are less deadly than those following abortion, but rather the reverse.

Again, the interval which elapses between the onset of the symptoms and the performance of a radical operation appears to be no more reliable as a guide to prognosis than any other indication which we possess. This is well brought out by a study of Teacher's list of 99 cases in which a radical operation was performed. In only 81 are the necessary data available, and we find that of these 50 recovered and 31 died. In the 50 recoveries the average interval which elapsed between the onset of symptoms and the radical operation was 4½ months; in the 31 fatalities the average interval was 4 months. Recovery is noted in a case where the interval was as long as 14 months, and death occurred in more than one case where the interval had not been longer than one month. It is possible that the true clinical guide to the degree of malignancy may lie in the length of time which elapses between the termination of the last pregnancy and the appearance of the first symptoms of the disease. As already stated, this point is often a difficult one to settle, owing to the uncertainty which surrounds the question of the occurrence and nature of the last preceding pregnancy. In this connection, the only cases which can be profitably utilised are those in which the disease developed during the course of the first pregnancy; and of the 14 cases of this kind (Teacher) 7 recovered and 7 died, giving a mortality of 50 per cent, which compares with a total mortality for all cases of 34·2 per cent. This appears to indicate that a close association with pregnancy is attended by a high degree of virulence, but further information is certainly required upon this point.

It follows from all that has been said that the duration of the disease and the expectation of life are very difficult to determine, and are subject to very wide variations. The mode of termination is by general dissemination, or by sepsis, and often, probably, by the two combined. In the cases accompanying perforating hydatidiform mole, death from hæmorrhage following spontaneous perforation of the uterus has been noted. The usual distribution of the metastases has been described in a previous paragraph. An interesting case has recently been reported by Hammerschlag in which a primary uterine growth was apparently cured by repeated curetting, but the patient died suddenly from internal hæmorrhage after an interval of a year, during which she menstruated regularly. At the autopsy the hæmorrhage was found to have proceeded from a metastatic growth involving the right ovary.

IX. **Treatment.**—In the present imperfect state of our knowledge of its clinical features, the only possible treatment for this grave disease is immediate removal of the primary growth along with the whole organ affected, wherever this is practicable. No practical importance can be attached at present to the remarkable cases of von Fleischmann and Hörmann already alluded to, in which permanent cure appeared to have followed curetting. In a case described by Burdzinsky spontaneous healing of vaginal metastases was seen, but six months later the patient died from generalised metastasis. The number of cases in which even the radical operation has failed to check the advance of the disease is considerable, and no confidence whatever can be placed in any measures less decisive than this. Until we know more of the conditions which determine the degree of virulence which it manifests, no other principle of treatment can be formulated.

Notwithstanding the enfeebled condition to which the patient has usually been reduced before seeking advice, radical operation is not attended by a particularly high immediate mortality. Thus we find that among the 99 cases in Teacher's list which were submitted to radical operation by removal of the uterus, 11 died within a few days—*i.e.* the immediate mortality was 11·1 per cent. This is only slightly higher than the immediate mortality of the same operation undertaken under modern methods of asepsis and by practised operators for malignant disease of other varieties. Technical difficulties from hæmorrhage have been reported in cases where the growth had extended beyond the limits of the uterus, but with this exception there is nothing to complicate the procedure except the enfeebled condition of the patient. The tubes and ovaries should be removed with the uterus in all cases, owing to the difficulty of detecting small metastatic growths in these organs by naked-eye examination.

The ultimate prognosis of radical operation does not compare unfavourably with that of other forms of malignant disease of the uterus. Out of 63 instances in Teacher's list of cases of the radical operation, only 13 could be reported in good health two years after the operation. This period of two years is now generally accepted as the index of "cure" after operation for malignant disease, so that the percentage of cures of chorionepithelioma, so far as our statistics serve us, is fair. It is important to remember that in the case of this disease the presence of metastases is by no means to be regarded as a contra-indication to radical operation, owing to the considerable number of cases in which metastases have been observed to disappear spontaneously after the removal of the primary growth.

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DISEASES OF THE OVARY

I. Anatomy and Physiology

There is probably no portion of the human body which has been more carefully studied by the anatomist and the physiologist than the ovary; yet in spite of all the labour and research bestowed upon it, many fundamental questions still remain unsettled. Until more light is thrown upon these, much of the pathology of the diseases to which the organ is liable must be a matter of conjecture.

It is not our intention in this article to give any detailed account of regional or structural anatomy, but to review briefly those points which have an important bearing upon disease.

The ovary lies for its greater part free in the abdominal cavity but rests in a more or less marked depression upon the posterior aspect of the broad ligament. This depression represents the ovarian sac, a structure highly developed in some mammals: in the rat and mouse the gland lies in a closed pouch of peritoneum, and into this the distal end of the Fallopian tube opens; in the hyæna the sac communicates with the cœlom by a small, fringed orifice only, whilst forms intermediate between those of the mouse and the human being are seen in other animals. There is reason to believe that a reversion to type is occasionally found, and that one form of tubo-ovarian cyst depends upon a persistence of the more primitive arrangement.

The relation of the ovary to the Fallopian tube has important pathological bearings. The tube runs outwards from the uterus, and, crossing in front of the anterior border and external surface of the ovary, a little below the superior pole, becomes applied to the posterior border. One of the fimbriæ, longer than its fellows, and termed the ovarian fimbria, reaches to the inferior pole, or slightly beyond. This fimbria is not, as is often stated, attached along its whole length, but only by its terminal extremity. In certain forms of ovarian tumour it forms an important landmark.

Age changes.—At birth the ovary is a flattened, elongated body with crenated edges; its length three or four times greater than its breadth. A change of form occurs gradually, so that by the time puberty is reached it has assumed the well-known oval shape; from now until the menopause its general outline remains unchanged, but as successive ova are discharged corrugations appear, which may be so well marked as to suggest the convolutions of the brain. After the climacteric the organ atrophies, and in old age it is represented by a small mass of fibrous tissue and blood-vessels.

In the ovary three separate zones may be distinguished:—1. The germinal epithelium. 2. The cortex or zona parenchymatosa. 3. The medulla or zona vasculosa.

1. *The germinal epithelium*, the essential part of the female sex-gland, consists of a single layer of low, cubical, epithelial cells resting upon a basement membrane; from down-growths of these cells which arise in fœtal and possibly also in early post-natal life, the ova are derived. Immediately beneath the germinal epithelium is found—

2. *The cortical or parenchymatous zone.*—This layer consists of stroma and follicles. The stroma is composed of interlacing fibres with numerous spindle-shaped, nucleated cells. Elastic tissue also is present. In general form and arrangement the stroma strongly suggests embryonic connective tissue, and bears a close resemblance to spindle-celled sarcoma, a fact which must be borne in mind before forming an opinion on the malignant nature of solid connective tissue tumours of the ovary. As the periphery of the gland is approached the number of cells diminishes, and the outer portion consists almost entirely of fibres arranged parallel to the surface; these constitute a strong investment for the ovary, which receives the name of "the tunica albuginea." The follicles are cyst-like bodies, of size varying according to the degree of development. The smaller follicles lie in several layers near the periphery; the larger are situated more deeply, and as they ripen approach the surface, from which they ultimately project. The resting

follicle possesses a centrally situated ovum, surrounded by a single layer of flattened spindle cells, difficult to discriminate from those of the surrounding stroma. When the follicles begin to ripen these cells become cuboidal, nuclear figures appear in them, and a cell proliferation takes place. Some of these cells undergo fluid degeneration, and vacuolated areas result, the process continuing until a considerable part of the follicle is filled with fluid, derived partly from cell degeneration, but partly by transudation through the vessel walls. Whilst these changes are taking place inside the follicle, the stroma which immediately surrounds it undergoes important developments and becomes differentiated into a capsule or theca.

The fully developed theca consists of an outer layer of concentrically arranged stroma cells (the *theca externa*), an inner layer of more differentiated oval or rounded stroma cells (the *theca interna*), and inside this a structureless membrane (the *membrana propria folliculi*), to which the outermost layer of granulosa cells is attached by foot-like processes. The epithelial lining of the follicle (the *membrana granulosa*) consists, as already stated, of an outer layer of cubical and several inner layers of rounded or polygonal cells. At one spot the membrane is much thicker than elsewhere, and forms a mound or eminence in which the ovum is embedded (the *discus proligerus*).

3. *The medulla or vascular zone.*—At the hilum of the ovary blood-vessels enter in such numbers that scarce any other tissue is present; in the medulla or central part of the gland the vessels are still very numerous, but separated from one another by connective tissue arranged much more loosely than in the cortex. The arteries have a curious cork-screw course: a peculiarity which they retain even in their finer ramifications. The veins in the neighbourhood of the hilum are mingled with muscle fibres to form a special corpus cavernosum (the *bulbus ovari*). A section through this part of the ovary has the appearance of erectile tissue.

In view of the great importance of epithelial tumours of the ovary it is necessary to consider further the varieties and origin of the epithelial structures which are normally present.

Epithelium is found in three situations:—1. On the surface, as the germinal epithelium. 2. As the lining of the Graafian follicles. 3. In the form of certain tubular structures, found chiefly in the neighbourhood of the hilum, and known as the medullary cords of Kölliker.

1. *The germinal epithelium* arises from a special development of the cœlomic endothelial cells covering the inner surface of the Wolffian body; these cells form a distinct elevation, which marks the site of the future sex-gland, and contains large, clear cells—the primordial ova. In the adult it is usually represented by a single layer of cubical cells; but occasionally variations are seen, the cells being cylindrical or even ciliated. This abnormality is sometimes due to changes in the germinal cells themselves, but under certain conditions, both congenital and the result of disease, the epithelium from the ovarian fimbria may spread to the surface of the ovary, which thus attains a partial covering of Müllerian

cells. Upon these changes in the surface epithelium many theories of the origin of ovarian tumours have been based.

2. *The follicular epithelium.*—Whilst all observers agree that the ova arise from cells of the germinal epithelium, there is by no means the same unanimity of opinion with regard to the origin of the granulosa cells.

The most widely accepted view is that of Waldeyer. By proliferation of the germinal epithelium a mass of cells, consisting of primordial ova and smaller, rounded cells, is produced; up-growths from the connective tissue of the subjacent Wolffian body divide this mass into columns of cells known as Pflüger's egg-tubes; each tube consists of a large primordial ovum surrounded by smaller cells. According to Waldeyer these smaller cells develop into the membrana granulosa. The second view is that propounded by Kölliker. The medullary cords consist of tubules lined by a single layer of columnar epithelial cells, sometimes ciliated, and represent persistent Wolffian remains. The vertical tubules of the parovarium pass from the duct of Gartner, between the two layers of the broad ligament, to terminate normally in the hilum of the ovary. Occasionally they penetrate almost to the cortical layer, and constitute the medullary cords. According to Kölliker it is from these structures that the granulosa cells are derived.

The third view, and the one which our own observations compel us to accept, was brought forward by Foulis in 1878. He stated that the granulosa epithelium was derived from the connective tissue stroma of the ovary. This view is based upon two facts: (*a*) that the cells surrounding the resting follicle differ very little from those of the ovarian stroma; and (*b*) that in young children the ova are in direct contact with the stroma, and no trace of epithelium or of cell differentiation is present. Most recent observations, particularly the valuable work of Clark and of Stevens, tend to strengthen this view.

3. *Wolffian epithelium.*—The medullary cords of Kölliker have already been described, but it must not be forgotten that tubular structures may be found in the ovary which arise quite independently of and apart from Wolffian remains. As we shall show later, although the proliferation of the germinal epithelium ceases normally at, or soon after birth, there is reason to believe that under pathological conditions later down-growths in the form of tubes lined by epithelium may occur.

Functions of the Ovary.—The obvious function of the ovary is the production of ova; but from the far-reaching results which follow the complete removal of both glands, particularly in early life, it has long been suspected that the ovaries in some way profoundly affect the general tissue metabolism. This influence, as in the case of the thyroid and other ductless glands, is believed to be exerted through an internal secretion. Direct proof of the presence of such a secretion cannot at present be obtained. The supposition rests upon experimental evidence of three kinds: (1) the effects of complete removal of the ovaries; (2) the effects of transplantation of ovarian tissues in subjects whose ovaries have been previously removed; (3) the effects of the administration of ovarian extracts.

1. It is well known that if the ovaries be completely removed from a woman in the child-bearing period of life symptoms of the menopause (often in an exaggerated form) occur, and that these are followed by atrophic changes in the vagina, the uterus, and the breasts. It is known that if even a small portion of ovarian tissue be left the same results do not follow, hence they cannot be regarded as due to shock or surgical manipulations.

2. It is stated that transplantation of an ovary from a second subject into the peritoneal cavity of a patient from whom both ovaries have been previously removed will prevent the premature menopause. The evidence available upon this point is totally unconvincing. Transplantation of ovaries in the lower animals has been successfully accomplished on many occasions, but a similar result in the human subject is at present unknown.

3. Administration of preparations of the ovary in the form of the fresh gland, the dried gland, and the extract, have been extensively tried in cases of amenorrhœa, chlorosis, premature menopause, and many other conditions. The results have been disappointing: improvement has undoubtedly followed this form of treatment in some cases, but whether their improvement should be regarded as *post* or *propter* is not easy to determine.

We are justified in saying that the ovary possesses functions other than those of reproduction, for the onset and decline of ovarian activity are marked by profound constitutional changes; and judging from analogy, these functions are probably performed through the existence of an internal secretion.

The Corpus Luteum.—As a result of gradual increase in the liquor folliculi the tension upon the walls of the follicle rises, and the ovum is forced towards the surface. When the period of ovulation approaches, the ovary is engorged with blood, the tension rises still higher, the circulation in the most distal portion of the follicle wall ceases, and a small dark area of necrosis becomes visible; this is "the stigma," the spot of rupture of the follicle. After rupture the cavity is occupied by a varying quantity of blood and by cells of the granulosa, many of which are in a state of degeneration; the membrana propria no longer exists as an intact line, but presents gaps through which blood-vessels and lutein cells have passed. The theca interna is thrown into wavy folds.

A section through a fully developed corpus luteum shows a central blood-clot surrounded by a band of little differentiated connective tissue (the membrana propria). Outside this is the lutein layer, composed of cells which in structure and arrangement bear a striking resemblance to those of the suprarenal gland; they are polyhedral, possess a single rounded nucleus, and are of a bright yellow colour. The colour is due to the presence in the cell protoplasm of granules of pigment.

The lutein pigment first described and named by Thudichum is a member of a large group of nitrogen-free, unstable pigments, which are widely distributed in the animal and vegetable kingdoms. Members of this group cause the familiar tints of fat, yolk of egg, and blood serum; as well as of vegetables, such as the carrot. Lipochromes are characterised by showing one or two absorption bands towards the violet end of the spectrum, and by yielding a blue colour when the solid pigments are treated with sulphuric or nitric acid; in many instances a solution of iodine produces a similar colour (A. E. Garrod).

The lutein layer is traversed by septa, which pass from the theca externa to the membrana propria. These septa are well supplied with blood-vessels and lymphatics, and by their attachments cause the festooned appearance of the lutein tissue.

The central clot is invaded by the lutein cells, and simultaneously vascular loops from the connective tissue septa make their way into it; eventually the blood-pigment is removed by leucocytes, and the clot is decolorised. The lutein cells have only a brief life, and even before the corpus has reached full development they undergo fatty and hyaline degeneration, ultimately disappearing entirely. The cavity is finally obliterated by young connective tissue, which resembles closely that of the surrounding stroma. In women who are approaching the menopause, and in whom the ovarian circulation is less active, the same degree of repair is not attained; the cavity is filled by a mass of hyalin, in which only few connective tissue cells and degenerate blood-vessels can be seen. These hyaline structures (the so-called corpora fibrosa) are eventually invaded and replaced by stroma cells.

Much controversy still centres around the origin of the lutein cells. Sabotta and many others regard them as products of the membrana granulosa. His, Kölliker, Nagel, and most recent workers believe that they arise from the theca interna, and are therefore connective tissue cells. This view our own observations lead us to support.

Corpora lutea are found in the ovary between the ages of puberty and the menopause only, although from birth onwards ova are continually ripening and disappearing. What becomes of these ova? The subject has recently been investigated by Stevens. He finds that when in premenstrual life a follicle ripens, the cells of the granulosa invade the ovum, eating it up and destroying it; the invading cells themselves speedily undergo necrosis, and are in turn absorbed by granulation tissue derived from the theca. Stevens points out that the ovary possesses two functions—(1) the production and maturation of ova, and (2) the formation of an internal secretion: ova are not required before puberty, and the follicles do not rupture, but the ova become absorbed. The internal secretion probably plays an important part in determining the development of the child, and it may be that these constant changes in the Graafian follicles are in some way the source of this secretion.

Until recently it was believed that the sole function of the corpus luteum was to obliterate, without the formation of scar tissue, the cavity left in the ruptured follicle; for, were the processes of repair those which obtain in the healing of wounds, the ovary would eventually be converted into a mass of cicatricial tissue, and its functions as an egg-producing gland be lost. Doubtless it serves this purpose, but, in addition, modern workers have attributed to it a new and important rôle. According to Fränkel, the corpus luteum is itself a gland, renewed every month, determining in some fashion the onset of menstruation, and, when impregnation takes place, presiding over the embedding of the ovum in the uterine mucosa. He believes that the menstrual and ovulation cycles are not synchronous, that ovulation precedes menstruation by about fourteen days, and that the due formation of the corpus luteum is necessary for the establishment of the menstrual flow. In eight cases of ventrofixation of the uterus Fränkel claims to have prevented the onset of the approaching menstrual flow by ignipuncture of a fresh corpus luteum, or excision of a follicle which appeared to be on the point of rupture.

He finds further that in early pregnancy destruction or removal of the corpus luteum is followed by expulsion of the ovum, whilst removal of portions of ovary which do not involve the loss of this body is followed by no such result. The theory based upon this experimental work finds some support in the fact, recently recognised, that hydatidiform mole (a condition in which there is excessive development of trophoblast) is often associated with cysts of the corpus luteum, and with an over-production of lutein cells (*vide* p. 403).

Fränkel's work is interesting and suggestive, but his conclusions must be received with caution until further observations have added to our knowledge.

II. TUMOURS OF THE OVARY

In spite of recent advances in pathology we are still unable to give a satisfactory classification of ovarian tumours. We propose to avoid as far as possible the minute subdivision which has been the first and most natural result of the labours of investigators in a new field, and to avoid also the somewhat speculative views of the origin of the different varieties. Whilst for the most part the characteristic features of the principal classes are easily recognised, the variations and combinations of them are so numerous that in the present state of our knowledge it is often not practicable to classify a particular tumour with certainty. Innocent growths pass by almost imperceptible gradations into malignant; solid tumours develop cysts, and cystic tumours develop solid masses; papillomata grow both in cystic tumours and on the surface of the ovary, without cyst-formation; and cysts with papillomatous or teratomatous contents occur as isolated growths, or as parts of a tumour of different character.

Follicular Cysts (Hydrops follicularis).—As each Graafian follicle ripens, it forms for the time being a small cyst upon the surface of the ovary; under certain conditions rupture of the follicle does not occur, and changes leading to the formation of larger cysts result. The simple unilocular follicle cysts of the ovary belong to the group of retention cysts.

It is a matter of great difficulty to define where physiological processes end and pathological change begins. We have no accurate knowledge of the size which a normal follicle may reach; usually we fail to find healthy ova in follicles larger than a cherry, and in those of greater dimensions there is invariably evidence of degenerative processes.

Simple follicular cysts are seldom larger than a golf-ball, but in rare cases they attain a size much greater than this. They may be single or multiple, but as they grow and develop the smaller multiple cysts become merged into one by absorption and disappearance of the tissues which originally separated them. By the simultaneous degeneration of many follicles the ovary may be converted into a tumour consisting on section of a number of cysts, seldom larger than a cherry, and separated from one another by thin septa of ovarian stroma. To an ovary in this condition the term "Rokitansky's tumour" is applied. The wall is composed of fibrous tissue, in the larger cysts often thin, translucent, and arranged in fascia-like layers; microscopically we distinguish an outer densely fibrous portion and an inner more cellular and vascular. The lining consists of a single row of epithelial cells, cubical or columnar, occasionally ciliated; as the cyst-contents increase, these cells become flattened, and eventually disappear. The intra-cystic fluid—clear, yellow, sometimes blood-stained—is derived in part from degeneration of cells of the membrana granulosa, in part from exudation through the vessel walls. Occasionally small wart-like projections are seen on the inner surface; these consist of loose-meshed connective tissue growths which have invaginated the epithelium in front of them; they are almost invariably covered by cells of the cubical type. The conditions under which follicular cysts develop are not definitely known. It must be remembered that many of the ovaries described as cystic, and not infrequently removed by operation for the cure of pelvic pain, are in no way pathological: as stated previously, the normal follicle may attain a considerable size before rupture, and two or three ripe follicles may be seen in a single ovary. The formation of retention cysts probably depends upon the prevention of rupture by an abnormally resistant theca or by a thickened albuginea; the membrana granulosa then undergoes degeneration, the ovum is destroyed, and fluid exudes from the vessels of the theca interna.

Associated changes are often, but not invariably, found in other parts of the ovary: there may be a scarcity of normal follicles, a hyaline degeneration of blood-vessels and stroma, with small-celled infiltration, and shaggy adhesions may be seen upon the surface; the whole appearance indicating a chronic oöphoritis. It is probable that by these sclerotic inflammatory changes rupture of the follicle is prevented. This view of their origin, is not, however, universally accepted. Nagel maintains that the condition known as follicular degeneration depends solely upon the fact that the ovary contains a number of ripe follicles; he states that in the smaller cysts he has invariably found normal ova, and believes that those of larger size arise either in corpora lutea or in later inclusions of the germinal epithelium within the ovarian stroma. These cysts may be present in any ovary which contains Graafian follicles; we have seen them in the fœtus, in the newly-born infant, and in women at the time of the menopause. They rarely give rise to symptoms or interfere with the normal functions of the organ; menstruation, ovulation, and pregnancy take place in their usual course. Progressive enlargement beyond a moderate size is not common, and any of the cysts may rupture and be cured spontaneously.

Cysts of the Corpus Luteum seldom attain a size greater than a walnut, but have been seen as large as a man's head. To the naked eye they are marked by two features—the thickness of their walls, and the presence therein of a bright yellow pigmented layer. The outer part of the wall is composed of modified ovarian stroma; the inner part always possesses a wavy, folded appearance, and contains lutein tissue.

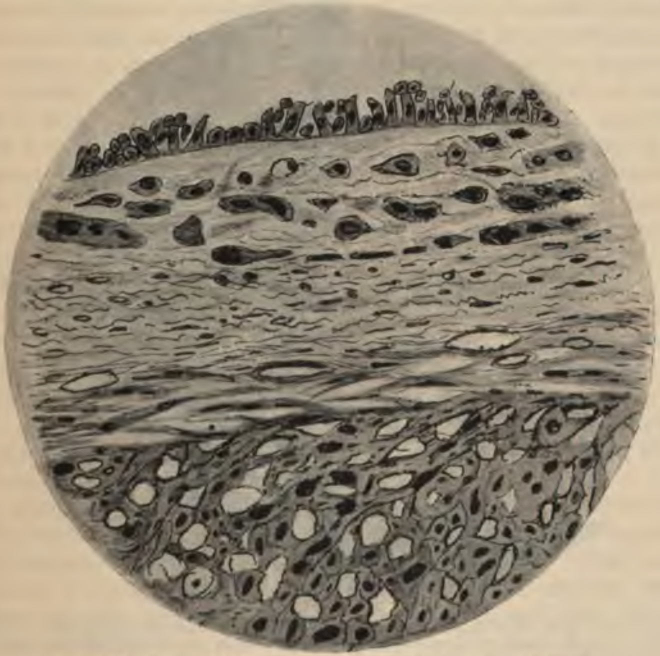


Fig. 114.—Lutein Cyst. Showing a lining of columnar epithelium.

Two varieties of corpus luteum cyst are recognised: in the one an innermost lining of epithelial cells is present; in the other this is absent. In the first group the epithelium consists of a single row of cells (Fig. 114); these are of very diverse shapes and sizes,—cylindrical, cubical, or polyhedral,—and rest directly upon the wavy, yellow, lutein cell stratum. In old cysts the pigment layer disappears and becomes replaced by vascular granulation tissue.

The second variety possesses no epithelial lining; its place is taken by a layer of fibrinous material, or by a loose, reticulated connective tissue which sends out processes extending amongst the lutein cells.

A considerable number of cases have been recorded in which hydatidiform mole and chorionepithelioma have been associated with single or multiple corpus luteum cysts and with the dissemination of lutein cells through the ovarian stroma. The association is too frequent to be regarded as a mere coincidence, but the relation between the two conditions is as yet unexplained. It will be remembered that according to Fränkel's theory one function of the corpus luteum is to preside over the development of the trophoblast and the embedding of the ovum: it is interesting to find in these cases an overproduction of lutein cells in association with a condition of excessive proliferation and increased powers of invasion of the trophoblast. It is necessary to bear in mind that corpus luteum cysts are sometimes associated with pregnancies in every way normal, and are sometimes found in women who have not been recently pregnant. Grouzdew has recorded a case of a solid malignant growth arising in the corpus luteum; and a similar specimen has been described by Voigt. In the latter instance the growth was the size of a man's head, of soft consistence, and composed chiefly of lutein tissue

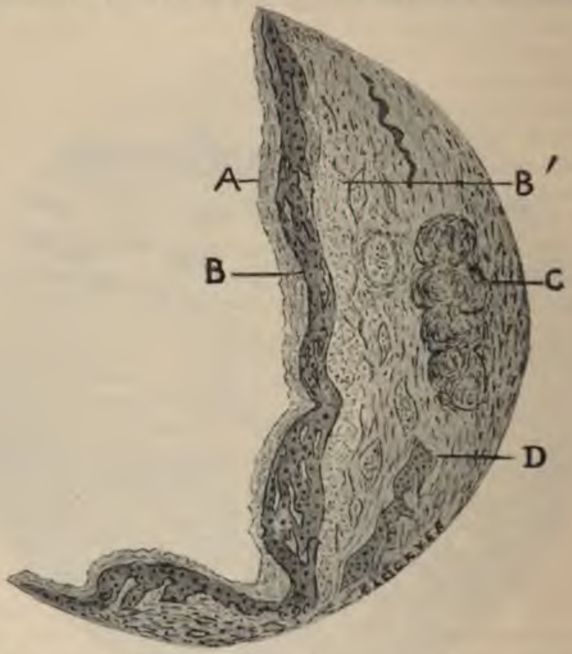


FIG. 115.—Lutein cyst showing A, Internal lining of fibrin; B, Lamellar arrangement of compressed lutein cells; B', Layer of blood-clot within theca interna; C, Corpus albicans; D, Displaced lutein tissue lying in ovarian stroma.

"which exhibited all the evidences of malignancy." Since lutein cells arise from the connective tissue cells of the theca interna, these growths must be regarded as sarcoma.

Cyst-adenoma.—Cyst-adenomata of the ovary are divided into two classes according to the nature of the fluid which they contain:—(1) Pseudomucinous cyst-adenomata; (2) Serous cyst-adenomata.

Pseudomucinous cyst-adenoma is the commonest form of ovarian tumour. It is a pedunculated innocent growth containing many loculi lined by tall columnar epithelial cells which secrete a sticky, glairy fluid known as pseudomucin. In their size and external characters tumours of this class differ greatly from one another. They are capable of reaching enormous dimensions, so that the emaciated patient appears to be a mere appendage to her tumour; a cyst of this kind which weighed 166 lbs. is preserved in the museum of St. Thomas's Hospital. In these days of surgical activity it is seldom that a growth is allowed to reach a size approaching this, but it is not uncommon to find cysts containing many pints of fluid. The tumours are often rounded, and present a dead-white surface which exhibits smooth elevations or bosses; these correspond to loculi or collections of loculi in the interior of the cyst. Over such an eminence the wall may be thin and almost translucent. The pedicle consists of the broad ligament and Fallopian tube; in it the branches of the ovarian artery, often greatly enlarged, pass to the walls of the tumour.

The Fallopian tube is sometimes elongated, and stretched over the surface of the cyst. It may attain a length of 18 inches or more, and still show very little change in its histological structure: the ovarian fimbria remains attached to the tumour. The vascular supply is extremely rich, and numbers of large blue veins are seen shining through the smooth outer coat of the wall.

On section we find a number of loculi bounded by fibrous tissue septa, to which are attached clusters of daughter cysts. The amount of solid matter varies greatly; in some specimens the whole tumour consists of a honeycomb-like mass with larger or smaller cavities, but more usually one or two loculi greatly exceed the others in size. Many of the contained cysts rupture and communicate with one another by larger or smaller openings in the septa; the remains of such cysts may be represented only by an orifice in a septum closely compressed against the inner surface of the wall. The very large cavities are probably invariably formed in this way, and the process may proceed to an extreme degree, so that the tumour becomes surgically unilocular, and its original multilocular character is revealed only by the presence of fibrous cords or bands on the inner aspect of the wall.

When microscopically examined, the greater part of the wall of the cyst is composed of fibrous tissue. The surface is covered originally by the normal superficial germ epithelium, but as the result of pressure from the enlarging tumour this disappears early, and the outer layer of the cyst wall then represents the tunica albuginea of the ovary. The fibrous tissue is arranged in two strata: an outer, dense and firm; an inner, loosely arranged, more cellular and vascular. In the smaller tumours this layer resembles closely the stroma of the normal ovary, but as the wall becomes more and more stretched the resemblance is lost. Embedded in this layer are numerous glandular epithelial depressions and cyst-like spaces. The wall is lined by tall columnar epithelium, each cell possessing a rounded nucleus situated near its base. The cell protoplasm is not homogeneous: two portions can be distinguished—a basal granular albuminous layer, and a clear central portion containing the pseudomucin. Many goblet cells are present. The cylindrical character of the cells is sometimes altered by pressure; they become cubical or flattened, and may undergo fatty or myxomatous change.

The epithelium is usually single-layered, but sometimes papillary processes project into the cyst cavities. These are found most often in cysts of moderate size, which exhibit a tendency to burrow between the two layers of the broad ligament, and are composed of several loculi of equal size rather than of one large and many small cavities. The papillæ—slender, branching, and feathery—consist of a stroma of delicate fibrillar connective tissue covered by a layer of tall cylindrical cells which never possess cilia. The stroma is vascular, and very apt to become œdematous or to undergo mucinoid degeneration. The papillæ arise from rapid proliferation of the lining epithelium: a small bud of young epithelial cells forms a little projection into the cavity of the cyst; the stroma, accompanied by loops of small blood-vessels, grows into the papillæ later. Cysts possessing these characters are regarded by some authors as forming a distinct variety, and are described under the name of "papillary pseudomucinous cysts."

A rare type of cyst-adenoma is the "cluster cyst" or "grape-like cyst." It sometimes happens that the tumour is extremely lobulated and composed of a number of thin pedunculated cysts of various sizes, so that to the naked eye it presents somewhat the appearance of a bunch of grapes. The microscopic features conform in all essentials to the description we have given above.

The fluid contained in ovarian cysts varies greatly in its characters; usually it is thinner in the larger than in the smaller cavities. Its colour may be yellow, green, red, or dark brown, depending upon the extent to which hæmorrhage has occurred into its interior, and the amount of admixture with blood-pigments. The specific gravity varies between 1·010 and 1·030. Microscopic examination reveals the presence of desquamated epithelial cells, many of them in a state of fatty degeneration, and large cells filled with yellow pigment which are possibly altered leucocytes; occasionally needle-shaped crystals are found. In the days before laparotomy was a common operation, great importance was attached to the microscopic examination of fluid removed by tapping from a distended abdomen, and the presence of "ovarian cells" and "compound granular corpuscles" was regarded as decisive in determining the existence of an ovarian cyst. The fluid has two sources of origin: first, from the cells of the epithelium, chiefly by a process of secretion, but also to a less extent by their degeneration; and, secondly, the exudation of serum from the blood-vessels. It contains albumen and large quantities of a substance known as pseudomucin. The latter, by boiling with mineral acids, can be split up into a carbohydrate and a proteid, but differs from mucin in its reaction to acetic acid. It is not formed by the degeneration of epithelial cells, but is a true secretion.

Serous cyst-adenoma is of rare occurrence. These growths are pedunculated and multilocular, but, in distinction from the pseudomucinous type, usually consist of only few loculi. They grow slowly, and rarely reach a large size. The wall is composed of fibrous tissue covered by ovarian surface epithelium, and lined by tall columnar epithelial cells possessing well-marked cilia. The contents consist of a clear yellow or greenish fluid, alkaline in reaction, containing a large amount of albumen, but no pseudomucin.

This form of cyst differs from the pseudomucinous variety in its comparatively slow growth, the physical and chemical characters of the contents of its loculi, and in the presence of cilia in its epithelial cells.

Age.—Adenomatous cysts are met with at all periods of life. In the body of the fœtus they may attain dimensions so great as to obstruct delivery; and one of us (W. S. A. G.) has removed a tumour of this kind from a patient eighty-three years of age. They are, however, commonest during the period of menstrual life.

Rate of growth.—This varies greatly with the characters of the tumour, and is most rapid in the glandular pseudomucinous cyst. In 1891 Mr. Bland-Sutton removed a large adenoma of the left ovary from a woman forty-eight years of age. At the operation the right ovary was inspected and appeared to be healthy; forty months later he removed from the same patient an ovarian cyst of the right side containing four litres of fluid.

Malignancy and metastasis.—Malignant invasion of the stroma by the lining epithelial cells is sometimes found in multilocular cysts. This question is discussed in the section upon carcinoma of the ovary.

As the result of rupture, metastatic or implantation growths are occasionally found in the subperitoneal tissue, or on the surface of the peritoneum. In the latter case they may give rise to a chronic peritonitis producing the condition known as "pseudomyxoma peritonei." In those rare instances in which after removal the abdominal scar has become the seat of "recurrence," it is probable that epithelial implantation took place at the time of operation.

Papillomatous Tumour of the Ovary.—Papillomatous growths occur in 10 per cent of ovarian tumours. We meet with them in two different forms: most frequently as small excrescences arising from the wall of an ovarian cystoma and projecting into its cavity; more rarely as sessile or pedunculated growths from the surface of the ovary. It is impossible to draw a sharp line of division between the two classes. A tumour composed chiefly of surface papillomata often contains small cystic cavities into which papillary processes may project, whilst a papillary cystoma may exhibit surface growths. Nevertheless, for purposes of description it will be convenient to observe the distinction, and to study first the papillomatous cystomata, and, secondly, the surface papillomata.

Papillomatous cystoma.—Even to the naked eye these tumours offer points of contrast to the cyst-adenoma just described: (1) They are usually bilateral; (2) They are composed of a smaller number of loculi—many indeed are unilocular; (3) Their fluid contents in most cases are thin, clear, and serous; (4) They seldom attain a size greater than a man's head. Usually they possess a pedicle, but are sometimes sessile, and often exhibit a tendency to burrow between the two layers of the broad ligament, when they may strip up the peritoneum and spread into the iliac fossa, or closely surround the rectum. As they grow they may displace the uterus, pushing it to one side or dragging it up into the abdomen, so that the fundus lies at the level of the umbilicus, and the supra-vaginal portion of the cervix is enormously elongated.

It must be remembered that parovarian cysts often contain papillary growths, and as they enlarge they may flatten and compress the ovary, rendering its identification a matter of great difficulty. Probably many of the intra-ligamentous papillary growths of the older writers were of this nature.

The tumour is smooth and rounded, seldom presenting the irregular bosses so common on the surface of the cystadenomata; the wall is dead white or glistening, and projecting from it are masses of papillomatous growth. These are of many varieties, some in the form of small rounded projections no larger than a pin's head, others are villous and arborescent. When they attain any considerable size their surface is warty and irregular, their colour white or pinkish, and their consistence soft and friable. All are connected to the cyst-wall by pedicles, some of which are thin and thread-like, others broad and short.

Microscopic structure.—(1) *The cyst wall.*—In the smaller tumours traces of ovarian tissue may be found in the wall, but in the larger cysts it can seldom be discovered. Three layers are distinguished: an outer of laminated connective tissue containing unstriped muscular fibres and only few cell elements; a middle, looser, more cellular and vascular; an inner, composed of epithelium resting upon a basement membrane. The epithelium in the larger cysts consists of a single layer, but in those of smaller size it may be several layers deep; in places gland-like invaginations are seen. The lining cells show great variety in size and shape; they are usually cubical, sometimes columnar, occasionally ciliated; all three forms may be found in the same tumour. Some pathologists have regarded polymorphism of epithelium and the presence of ciliated cells as pathognomonic of the papillary cystomata; this view, however, is incorrect. Another striking feature of the walls of these cysts is the presence of psammoma bodies in both the epithelial and connective tissue cells.

The surface papillary growths consist of a connective tissue stroma and an epithelial investment. The stroma in some cases resembles more or less closely the connective tissue of the normal ovary, and consists of short, wavy fibres with numerous spindle cells; more often we see a loose-meshed myxomatous stroma composed of a few star-shaped connective tissue cells, leucocytes, and newly formed blood-vessels. This form of tissue represents a stage of development rather than of degeneration, for many fibroblasts are present.

The epithelium is most often cylindrical, occasionally ciliated, sometimes cubical; in both epithelial and connective tissue cells psammoma bodies are frequently found. These vary in size from small microscopic objects to masses which are visible to the naked eye and easily appreciable to the touch; they consist of particles of calcareous material (carbonate and phosphate of calcium) arranged concentrically. Their development has been studied by Whitridge Williams. The affected cell swells up and loses its granular appearance, the cell contents undergo fluid degeneration, the nucleus becomes pushed to one side, and finally disappears. Several adjacent cells may undergo this change and fuse together; then, in either the single cell or the masses so formed, small calcareous grains are deposited in a concentric manner.

Mode of formation of the papillary processes.—The epithelium at one spot begins to proliferate and forms several layers; later, from the stroma beneath, connective-tissue spindle-shaped cells and small loops of newly-formed capillary blood-vessels grow up into the epithelial buds.

The cyst fluid is clear, watery, and of specific gravity 1·005 to 1·040. It contains albumen, epithelial elements, sometimes cholesterin and hæmatoidin crystals, very rarely mucinoid material. Occasionally it is coloured from old or recent hæmorrhages, and in the multilocular variety separate loculi may possess contents of different characters. A considerable portion of the fluid is probably furnished by transudation from the vessels of the papillary growths.

Frequency and growth.—In a series of 1058 ovariotomies collected by Whitridge Williams there were 100 instances of papillary tumours; the proportion to the glandular cystomata was as 1 to 10. They grow less rapidly than the latter, seldom attain so large a size, and sometimes, even in the absence of secondary growths, give rise to ascites.

These tumours stand on the border line between innocence and malignancy: so long as the papillomata are confined within the cyst cavity they behave as benign tumours; but if rupture of the cyst from violence, from fatty degeneration, or from pressure of the papillary masses occur, the growths become diffused over the peritoneum in all parts of the abdominal cavity. Even when this dissemination has taken place, if the cyst be completely removed the secondary deposit will in course of time shrivel and disappear. This fact has led Cullingworth to enter recently a strong plea for the complete removal of all cysts of doubtful malignancy. An explanation of the phenomenon has been suggested by Bland-Sutton: "The life of multiple warts is often very transient, and this is probably the case with peritoneal papillomata; but so long as the seed-supply continues new warts spring up and die, to be succeeded in their turn by a new crop. When the source of epithelium is renewed by operation the warts then existing die, and the crop is not renewed."

The advent of dissemination is marked by the development of ascites and sometimes also of hydrothorax. Occasionally with apparently innocent papillomatous cysts true metastases have been found in the lungs, pleura, lymphatics, and other structures; according to Williams they are always of embolic or lymphatic transference. Papillomatous tumours exhibit a marked tendency to become malignant, sarcomatous and carcinomatous changes being frequently seen; occasionally where the intra-cystic growths appear to be innocent the metastases are malignant, and *vice versa*.

(2) *Surface papillomata.*—Papillomatous growths on the surface of the ovary may form a single outgrowth or a cauliflower-like mass. They are sessile or pedunculated, sometimes possessing a pedicle of considerable length, and not thicker than a thread. The interior of the ovary may show very little change, or cysts, into which papillomata project, may be found.

The growths consist of a cellular stroma rich in blood-vessels and covered on the surface by a single layer of epithelium, usually cylindrical, often ciliated, sometimes almost flat. In both stroma and epithelium psammoma bodies are found. Through its pedicle the connective tissue of the growth is directly continuous with that of the ovary.

Processes derived from the germinal epithelium are seen extending into the ovarian stroma; these often appear as duct-like canals lined by ciliated epithelium.

The Origin of Adenomatous and Papillomatous Ovarian Cysts.—The origin of these tumours is still obscure. In the space at our disposal we cannot enter into a discussion of the various theories which have been advanced, but can only very briefly review the conclusions of some of the workers whose writings have received most attention.

Between 1880 and 1890 Mr. Alban Doran, in a series of papers, endeavoured to prove that papillomatous cysts arise in connection with Wolffian remains, and adenomatous cysts in connection with Graafian follicles; his views have been largely adopted in this country, and are still widely taught. This theory of the origin of papillomatous cysts is based partly upon histological and partly upon gross anatomical considerations. The epithelial cells of the cysts resemble those of the parovarium, and Doran points out that papillomatous cysts often burrow between the layers of the broad ligament and involve the hilum alone, the oöphoron remaining distinct; the occasional development of these cysts in the oöphoron may be accounted for by the fact that Wolffian tubules are sometimes found in this part of the gland. That some papillomatous cysts develop in the hilum of the ovary in connection with tubules of the parovarium is almost beyond dispute, but the later work of Whitridge Williams has clearly demonstrated that they also arise quite independently of Wolffian structures. Again, it is equally uncertain whether adenomatous cysts develop from the Graafian follicles, or possess anything in common with the granulosa cells; recent researches have cast grave doubts upon such a genesis, and no observer has ever seen a multilocular cystic adenoma developing from a Graafian follicle. In the present state of our knowledge, it is impossible to accept any such distinct and clearly defined difference of origin for the two forms of tumour.

In the section upon anatomy which stands at the beginning of this article we have discussed the epithelium found in different parts of the ovary, and to this section we would again refer the reader; for each variety there described has been made the basis of many conjectures.

Waldeyer, in 1870, concluded that cystomata were derived from structures analogous to Pflüger's ducts, which structures were either remnants from fœtal life or were formed later in the adult. Marchand, in 1878, showed that epithelium from the Fallopian tube might extend to the surface of the ovary, and believed that from such an extension, downgrowths, from which cystomata might develop, found their way into the substance of the gland. Glaischen, a few years later, stated that papillary cystomata take their origin from tubes lined by ciliated epithelium and derived from the germinal layer. Whitridge Williams, in 1894, concluded that all papillary cystomata have not one common origin, but that they may arise from Wolffian remains, from Müllerian surface epithelium, from germinal epithelium, or from the Graafian follicles.

Ovarian cysts have usually attained a large size before they are removed by operation, and are therefore unsuited for the study of the early stages of development; the best materials for this purpose are ovaries normal as far as their naked-eye characters are concerned, and cut in serial section. A series of eighty such observations has recently been reported by Walthard, and his paper is a valuable addition to our knowledge upon this abstruse subject. He finds very frequently in the stroma of the ovary collections of epithelial cells derived from, but seldom in connection with, the germinal epithelium. In these isolated masses the cells may have very diverse forms, and are capable of proliferation and cyst-formation. Sometimes the masses consisted of round or oval cells, with clear vesicular nuclei; sometimes the cells were arranged around a small cavity, and from them processes lined by a single layer of columnar epithelium grew out into the stroma; sometimes they formed tubular structures lined by ciliated epithelium, some of which contained branching papillæ. Walthard's work constitutes one more link in the chain of evidence which is being gradually forged, and which when completed will probably prove that ovarian cystomata most frequently arise neither from Wolffian remains nor from Graafian follicles, but from masses of epithelium derived from the germinal layer, which may grow and develop into cysts even after they have lain for many years quiescent in the ovarian stroma.

Figures 116-118 illustrate early stages in the development of cystic adenomata. The ovaries from which these sections were prepared presented nothing abnormal in their naked-eye characters. In each case a large multilocular cystic tumour of the opposite ovary was removed by operation.

Tubo-ovarian Cysts.—When, as sometimes happens, a hydro-salpinx and an ovarian cyst exist coincidently, inflammatory adhesions may form between the two, and later, by absorption of the septum, one single cyst cavity result. This is without doubt the commonest mode of formation of tubo-ovarian cysts. In the museum of St. Bartholomew's Hospital there is a very complete series of specimens illustrating the different stages in the process of fusion; these specimens have been described in vol. xxix. of the *Obstetrical Society's Transactions*. It must be remembered that many tumours which at first glance appear to be tubo-ovarian cysts prove on more careful examination to be specimens of hydro-salpinx in which the distal portion of the tube, greatly distended, conceals the flattened ovary.

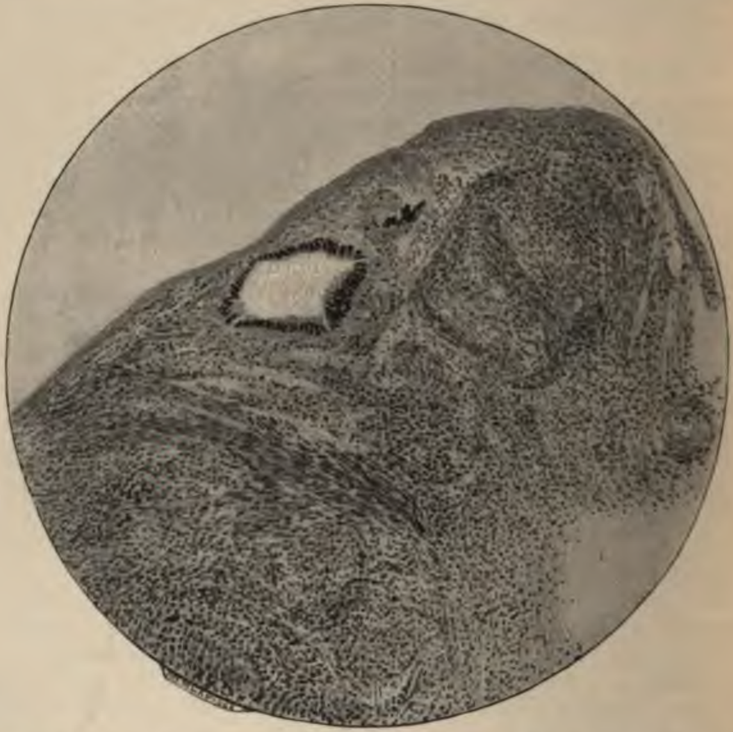


FIG. 116.—The surface of the ovary is destitute of epithelium. In the cortex is a tubular space lined by a single layer of columnar epithelium. To the right is a second smaller collection of epithelial cells.

A special variety has been described under the name of "ovarian hydrocele." We have already referred to the occasional persistence in the human being of the ovarian sac constantly present in some animals. In these cases the ovary is completely invested by a sac of peritoneum, constituting a tunica vaginalis into which the ostium of the tube opens. In animals, hydrocele of the tunica vaginalis of the ovary is a well-known condition, and according to Mr. Bland-Sutton is also occasionally found in the human subject. He describes its distinctive characters as follows:—The Fallopian tube, elongated and tortuous, opens by its ostium into a sac on the posterior aspect of the broad ligament; there is usually no evidence of inflammation, but the cyst may suppurate should the tube become infected; in small specimens the ovary projects on the floor of the sac, in larger specimens it is incorporated with the wall, and in very large tumours is unrecognisable.

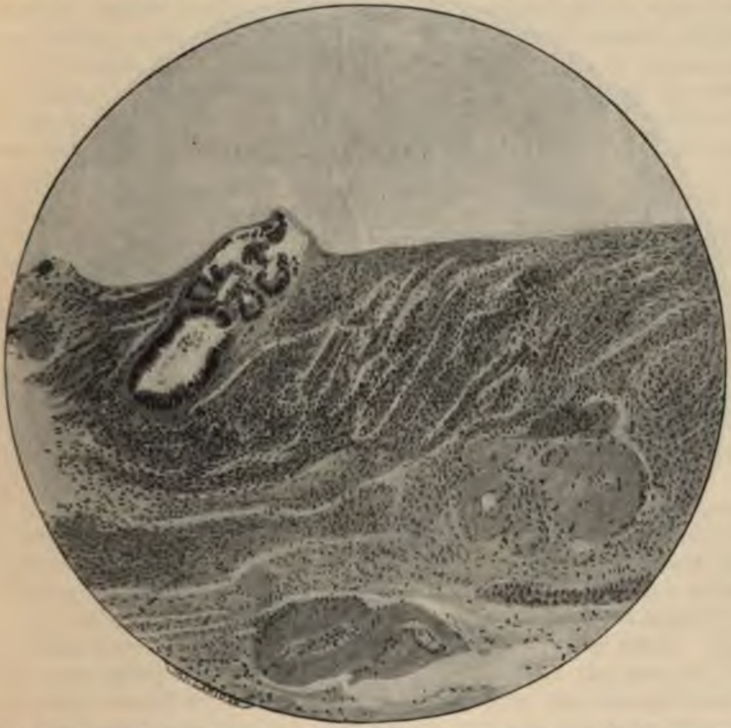


FIG. 117.—The section is in many respects similar to that shown in Fig. 116. In this specimen several tubular structures are seen grouped together in the same manner as the acini of a gland.

Teratoma.—This term is applied to a group of neoplasms containing heterogeneous tissue elements usually so far advanced in development as to resemble some one or more of the mature tissues or organs of the body. In some instances the structures may be recognised by their naked-eye characters; in others their nature is demonstrable only by the aid of the microscope.

These tumours were formerly divided into four classes:—(1) Simple dermoid cysts; (2) Complex dermoid cysts; (3) Cystic teratomata; (4) Solid teratomata.

The simple dermoids were regarded as epiblastic inclusion cysts, and contained only skin and its appendages; if other structures such as mucous membranes or canals lined by ciliated epithelium were present they became complex dermoid cysts; the presence of portions of a fœtus, brain, intestine, respiratory or generative rudiments, placed the tumour in one or other of the two last groups. Wilms has shown that this classification is founded upon an initial error, and that simple inclusion ectodermal cysts are probably never found in the ovary.

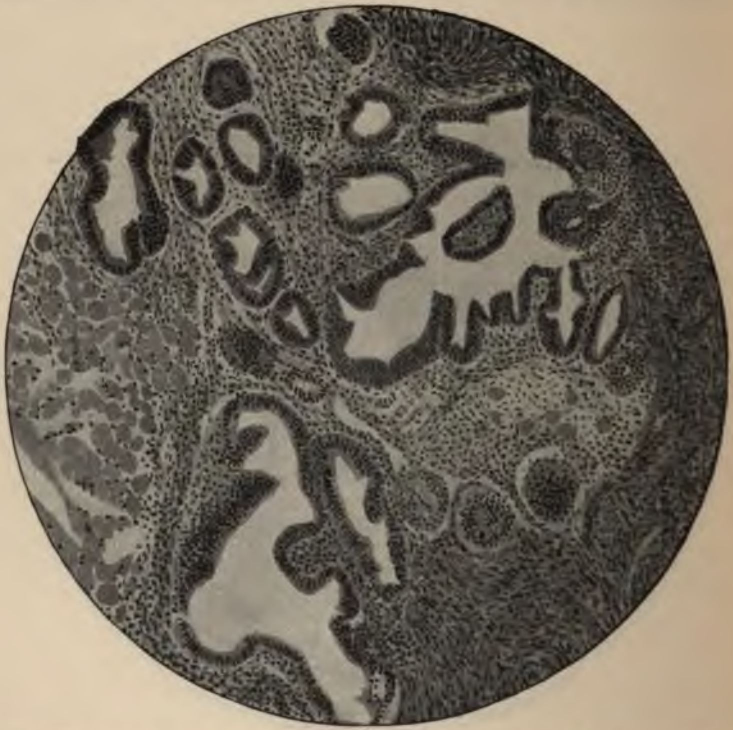


FIG. 118.—The glandular form is more clearly marked, and processes covered by columnar epithelium are seen projecting into the lumina. To the left of the section are lutein cells.

Two groups of tumours are to be distinguished:—(1) Teratomatous ovarian cysts; (2) Solid ovarian teratomata. This distinction is, however, one of degree rather than of kind: the cystic tumours contain solid portions, the solid tumours cystic spaces; both groups vary greatly in their structure and in the number and complexity of the tissues of which they are composed.

1. *Teratomatous ovarian cysts* are usually unilateral, but occasionally bilateral; they have been seen in the single ovary associated with a unicornute uterus, and in an accessory ovary; their growth is commonly extra-ligamentous, very rarely they lie partially or completely between the two layers of the broad ligament.

Ovarian tissue can usually be detected in the cyst wall, a point of great mportance, proving that the tumour develops not from the whole gland, but from one portion only; the ovarian tissue may be normal, but frequently presents cyst-like cavities. The relation between ovary and tumour varies; often the ovary is flattened and incorporated with the cyst wall to such an extent that it can be discovered only by microscopic examination; occasionally it forms a projection on the wall of the cyst; more rarely still the tumour is definitely pedunculated, and further by torsion and atrophy of the pedicle may lose its connection with the ovary, and become secondarily attached to some other abdominal viscus.

Generally spherical with a smooth, glistening surface, the cavity of the tumour is occupied by a thick sebaceous fluid mixed with hair; if twisting of the pedicle has occurred the contents may be mixed with blood. The fluid contains cell-remains, granular detritus, fat globules, and cholesterin plates; occasionally also small rounded bodies consisting of a nucleus of hair to which small masses of epithelium are adherent; hundreds of these balls may be found in one tumour.

From one part of the wall a nipple-like process often projects into the cavity; this is covered by skin from which grow a number of hairs of one olour only. The skin which covers this protuberance does not extend ound so as to form a lining for the whole cyst cavity, but is confined to a mall area around the base of the projection; the rest of the wall is smooth or covered by a dense granulation tissue in which are embedded hairs and holesterin plates. In this granulation layer we find also giant cells esembling closely the large multinucleated cells often found around a foreign body embedded in living tissues; they are grouped around the hairs which traverse, but never arise from, the granulation tissue. Hair ollicles are found only in the nipple-like process and the area of skin mmediately around it; the hairs themselves project into the cyst cavity, and it is in response to the irritation caused by these structures that the granulation layer is formed.

The nipple-like projection consists sometimes of skin and its appendages only, sometimes of mucous membrane traversed by epithelium-ined canals, and sometimes of structures—epiblastic, mesoblastic, and hypoblastic—which bear a close resemblance to those of the cephalic extremity of the embryo.

Under the skin it is common to find small flat plates of bone, and according to Wilms there is almost constantly a stratum of brain tissue beneath them. Wilms regards these projections not as simple tumours, but as rudimentary embryonal formations arising within an enclosing cyst. Through mechanical pressure their growth is hindered, and those tissues which develop earliest in the embryo alone survive. This explains why ectodermal and cephalic structures are represented more abundantly than those derived from the entoderm. The embryoma does not always form a distinct eminence; it is sometimes flattened, compressed, and incorporated into the cyst wall, but in these cases microscopic examination will disclose tissues derived from all three germinal layers. We do not know the relation of the embryoma to the cyst in which it is found. Pfannenstiel attributes the development of the embryonal rudiment to cyst formations; Wilms believes that the embryoma is the cause of the cyst. The cysts are usually unilocular and devoid of an epithelial lining; some, however, consist of two or three loculi, and occasionally we find embryomata developing in or associated with multilocular cyst-adenomata of the ovary.

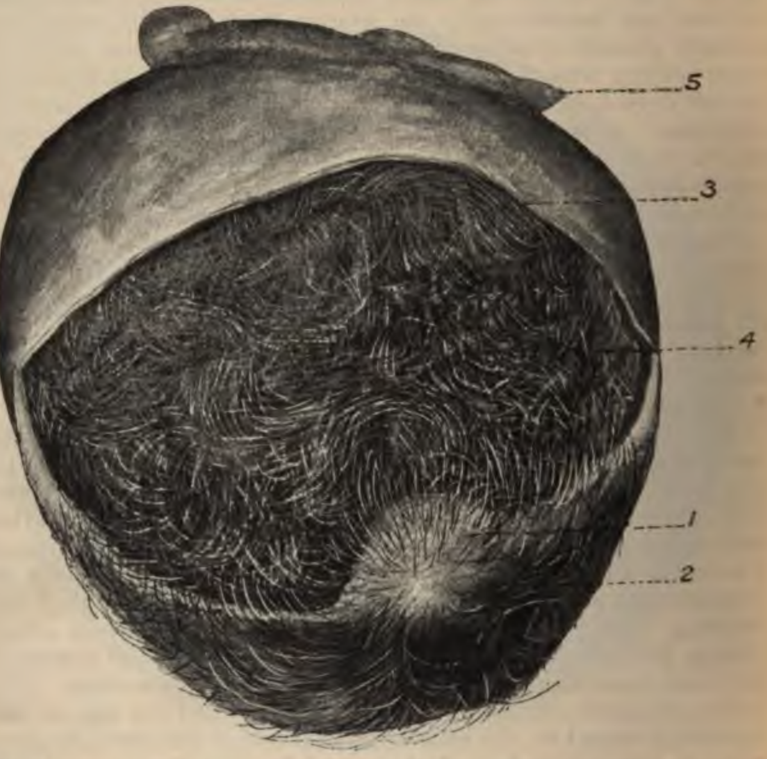
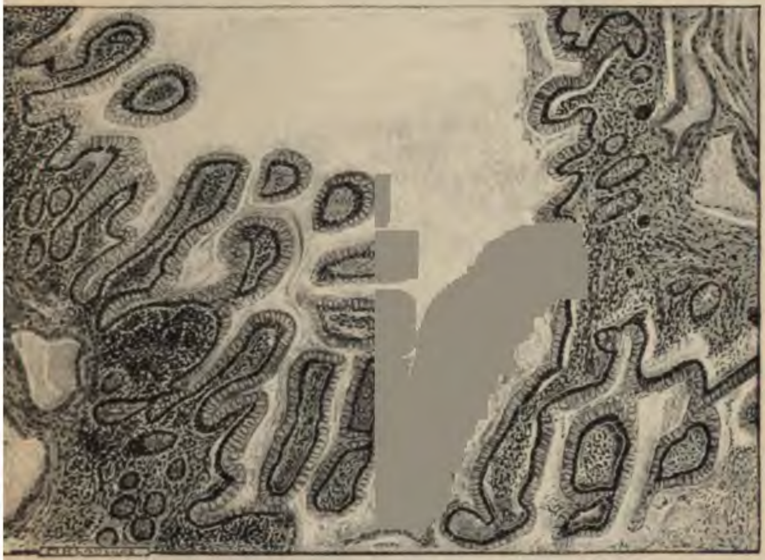


FIG. 119.—A teratomatous ovarian cyst showing (1) The nipple-shaped projection (embryoma); (2) Area of skin surrounding the nipple-shaped projection; (3) Cyst wall lined by granulation tissue containing hairs embedded in it; (4) Mass of hair occupying cyst cavity; (5) The Fallopian tube. (From a specimen in St. Bartholomew's Hospital Museum.)

Structures found in Teratomatus Cysts.—1. *Epiblast.*—The skin resembles in all respects that which normally covers the surface of the body, except that the papillæ are usually ill-marked and ch, corpuscles absent; pigment granules are present in the deeper ıta, and the epidermis is thick and commonly shed in broad es into the interior of the cyst cavity. The cutis vera rests n a well-developed fatty connective tissue layer in which we may l unstriped-muscle fibres. The hair varies in colour and in length; rs have been found measuring fifty inches; according to Bland-ton in old age they become white, and are eventually shed.

Sebaceous glands are present in large quantities; sweat glands are rare l usually ill-developed; their ducts lack the spiral arrangement so stant in normal structures.



120.—A section through the nipple-shaped projection marked (1) in Fig. 119. The tissues bear a very close resemblance to small intestine. A central cavity is lined by a mucous membrane which is covered by columnar epithelium and presents numerous villus-like projections. This mucous membrane rests upon a wall which contains unstriped muscle fibres.

Teeth are found in about 50 per cent of the cysts; they usually emble the canines or incisors, and possess one root only; they are often rounded at their base by a pink structure resembling the mucous mbrane of the gum. Sometimes two or three are embedded in flat tes of bone similar in form to the dental processes of the jaws. They ssess enamel, dentine and pulp, containing nerve fibrils; as many as 0 have been counted in a single cyst.

Nails are seldom seen, but occasionally are attached to the extremities phalanx-like portions of bone.

Mammary structures and nipple-like projections of skin have been scribed by Velits, Bland-Sutton, and others.

Nervous system.—We have already mentioned that brain-like tissues may frequently be detected; it is to be noted that whilst the central nervous system is frequently represented this is rarely the case with peripheral structures. We find commonly a reticulated neuroglia in which nerve fibres and nerve cells are sparsely scattered, but it is rare to find differentiation into a sheath and axis cylinder process. A ciliated central canal, ventricle-like widenings lined by ciliated epithelium, choroidal, and retinal structures have been repeatedly described.

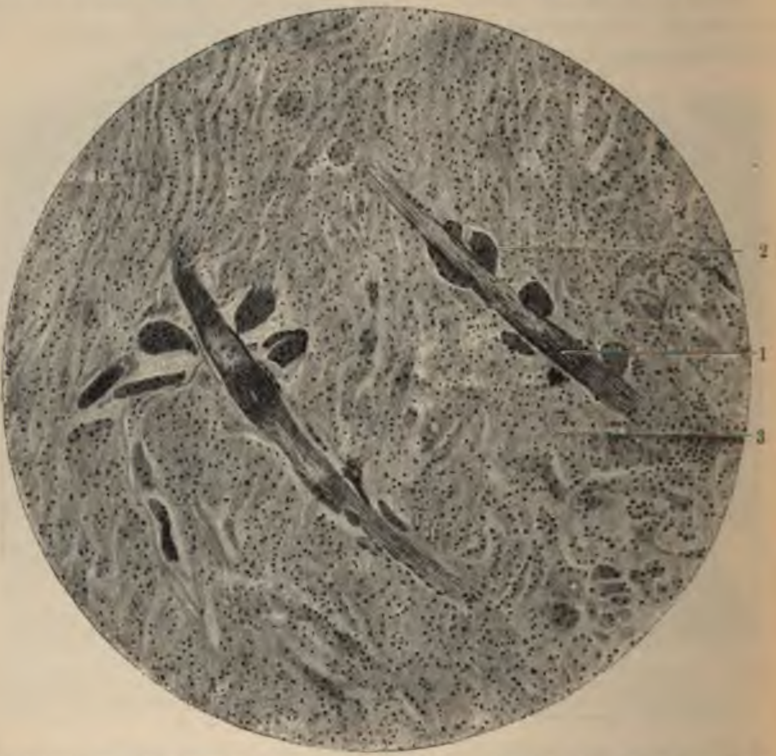


FIG. 121.—Section taken from cyst-wall at spot marked (3) in Fig. 119. The wall here contains no embryonal structures, it consists of granulation tissue in which are embedded hairs, and around the hairs are grouped giant-cells. (1) Hair; (2) Giant-cell; (3) Granulation tissue.

2. *Mesoblast.*—Reference to the presence of fibrous and fatty tissues has already been made; unstriped muscle is commonly present both as isolated bundles and in the walls of various organs; small islands of hyaline cartilage are common.

Bone.—A variety of bones have been described,—jaws, long bones, ribs, and phalanges. Wilms gives an illustration of a temporal bone with external auditory meatus and styloid process; he remarks that well-developed bones when present belong exclusively to the head region.

Blood-vessels.—The circulatory system of the embryoma is naturally in communication with that of the host, but vessels are formed from the tumour mesoderm; in one instance Wilms was able to recognise an external and an internal carotid artery.

3. *Hypoblast.*—This layer is little represented, often only by a central canal lined by cylindrical epithelium; thyroid-gland tissue and intestine we have found in our own specimens, stomach, trachea, and lungs have also been described.

Age of occurrence.—Teratomatous cysts have been seen at all periods of life; Heckton and Reissman speak of one in an eight months' fœtus, and Potter has recorded an example in a woman eighty-three years of age. They are, however, most common during the years of child-bearing life, and are seldom seen before puberty. Bland-Sutton has collected thirty-eight cases in girls under fifteen.

The rate of growth varies, but, generally speaking, this is the most slowly growing of all forms of ovarian cyst. Sänger has removed one which was known to have existed for twenty years, and Wilms has investigated another which had been growing for eight years; in this case sclerotic changes were marked in all the tissues. The cysts seldom attain a large size; it is rare to see them larger than a fœtal head. There is a specimen in St. Bartholomew's Hospital Museum the size of a football, and Wilms has described one as large as a man's head. We have already stated that an embryoma may become fused with or possibly develop in a cyst-adenoma, in which case the whole tumour may reach an enormous size.

Dissemination and occasional malignant characters.—Occasionally from violence or some other cause rupture of the cyst occurs, and its contents become scattered over the peritoneal cavity. Under these circumstances and by a process of implantation numerous small tumours having the characters of embryoma may be found in various parts of the abdomen. Kolaczek, Moore, Fränkel, and Grawitz have published such cases. This condition must be clearly differentiated from malignancy; the secondary tumours are to be regarded as the direct result of implantation of disseminated portions of the original tumour upon a peritoneal surface. They show no tendency whatever to invade or destroy the tissues upon which they have become implanted. The phenomenon is comparable in every way with that exhibited by papillomata which have escaped from the restraining influence of the cyst wall.

Teratomatous cysts are occasionally the seat of malignant disease. In 1894 Schwertassek collected twenty-two such cases; the malignant growths were in eleven instances carcinoma, in nine sarcoma, and in two endothelioma. The diagnosis rested upon combined microscopic and clinical evidence, and in more than half the cases autopsies, with histological examinations of the secondary deposits, were conducted.

In discussing the problem of malignancy various possibilities must be borne in mind. A carcinoma may develop in a pre-existing teratoma, or in an ovary another portion of which contains a teratoma; the tumour may, on the other hand, become invaded by a growth which had its origin in some contiguous organ, or be combined with a multilocular cyst which may itself be of a malignant nature. There can be no doubt that in many cases the malignant growth has arisen from tissues which formed part of the teratomatous cyst.

Solid embryoma is rare; it differs from the cystic variety in that whereas in the latter group the embryo rudiment develops within, and usually remains bounded by, a cyst wall, the solid tumours possess no such limiting capsule.

The patients are usually young adults; in the recorded cases we have been able to collect, the youngest was sixteen and the oldest forty-nine years of age. The tumours are capable of reaching enormous dimensions, and in some instances grow with great rapidity, attaining a large size within a few weeks. They are usually pedunculated, globular in shape, with a surface which is smooth or bossed; they possess a capsule composed of fibrous tissue and altered ovarian stroma. On section they are never completely solid, but contain small cyst-like spaces lined by epithelium and separated from one another by fibrous tissue tuberculæ.

Microscopically, derivatives of all three germinal layers are present; but the structures show no tendency to any regular formation, and the tissues occur in hopeless confusion, with no limit to their growth. The epithelium in places is atypical in form and arrangement, like that of a carcinoma, but there is present in addition an excessive growth of embryonal connective tissue after the type of sarcoma.

These growths are often intensely malignant, and after removal recur with the greatest rapidity; the metastatic deposits sometimes show the characters of carcinoma, sometimes of sarcoma, and sometimes consist of nodules of embryonic connective tissue. The investigation of a case of the last variety led Ewald to the conclusion that a solid teratoma of the ovary is a malignant tumour *per se*, and that the metastases often reproduce the histological structures of the original growth.

We have lately examined a solid embryoma removed by operation from a girl of sixteen. The weight of the tumour was 6½ lb. It consisted of a connective tissue stroma in which were embedded cystic spaces lined by epithelium, bone, cartilage, mucous glands, large intestine, brain tissue, areas of liver cells, mucous and sebaceous glands and masses of atypical glandular epithelium. These tissues were found in the utmost confusion with no definite ordered arrangement. Within two months of the removal of the tumour dissemination had occurred, and large masses of growth could be felt in various parts of the abdomen.

Genesis of Ovarian Teratomata.—Theories of the origin of these tumours are legion; at one time they were believed to be the result of impregnation by the devil, but Astruc of Krüger shrewdly remarks that devil-pregnancy occurs to those young women and widows "quae rationis et castitatis prae re ferunt speciem." Meckel in 1815 brought forward the theory of two ova and the inclusion of one foetus within the other. Shattock has recently pointed out the possibility of the inclusion of a

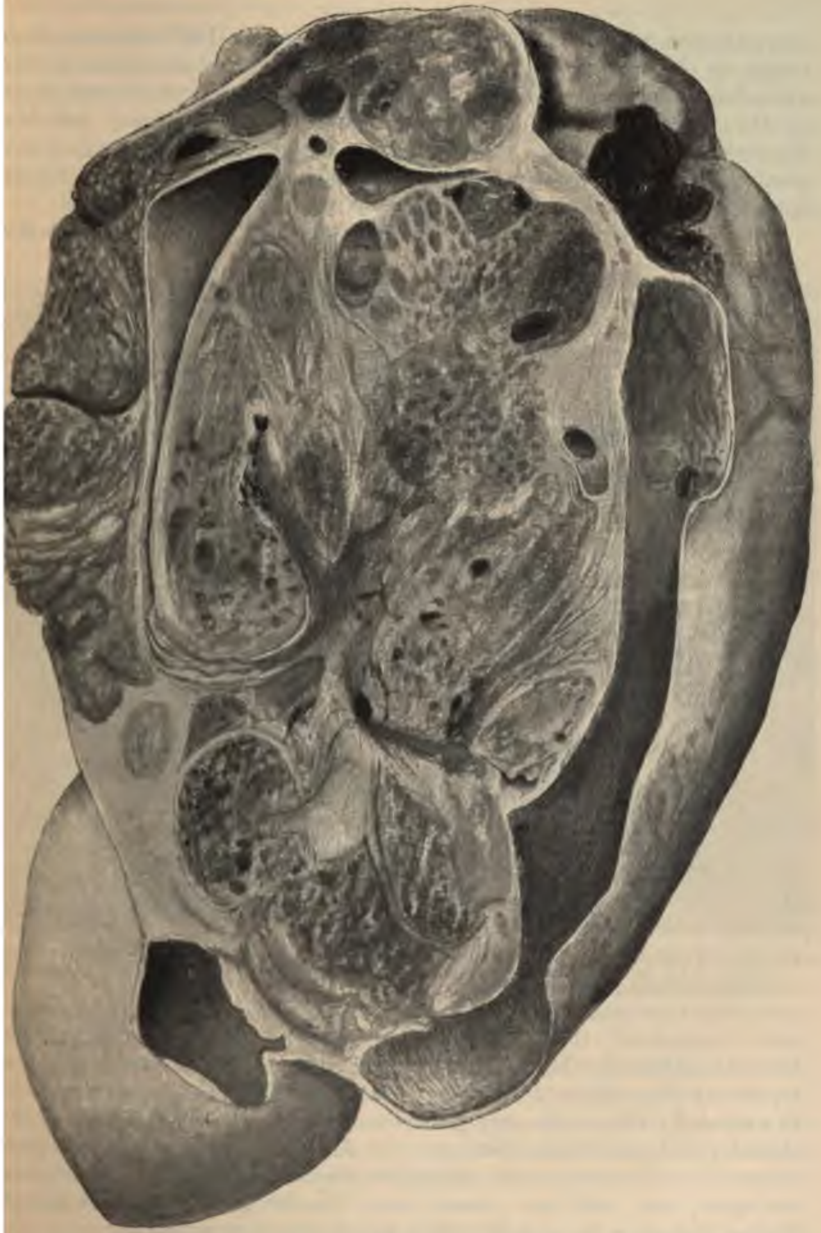


FIG. 122.—Solid teratoma of the ovary removed by operation from a girl 16 years of age. Within three months of operation masses of growth could be felt in various parts of the abdominal cavity. (From a specimen in St. Bartholomew's Hospital Museum.)

spermatozoon within the foetal ovary. Waldeyer in 1893 referred their origin to the ovary itself; he regards the tumours as analogous to the cyst-adenomata, and considers that both originate through metaplasia of the epithelium of Pflüger's tubes and of the Graafian follicles. Kroemer pointed out that ovarian dermoids consist of two parts, a cystic portion and an embryonal rudiment: he believes that the cyst develops from the follicle and the embryonic rudiment from the ovum.

Wilms and Pfannestiel working independently arrived at almost the same conclusions; they distinguish dermoids of the ovary and testicle from all others in that they contain rudiments of all three germinal layers. "The origin of an embryoma," writes Wilms, "must always be in a sex-cell; this is the only possible explanation of the existence of the three-layered germinal rudiment. . . . As to the cause of the proliferation of the cell we are as yet entirely in the dark." With this conclusion we agree, and until we possess more knowledge of the processes of tumour formation in general further speculation is unprofitable.

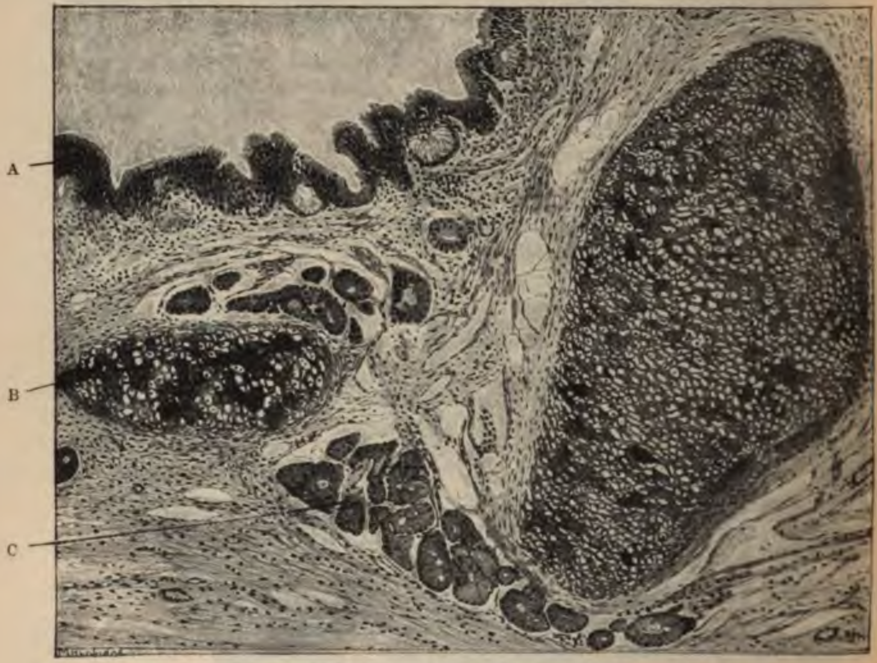


FIG. 122*a*.—A section from part of the tumour shown in Fig. 122. Cartilage, unstriped muscle, mucous glands, and a mucous membrane resembling that of the small intestine are seen. *A*, Intestinal mucosa; *B*, cartilage; *C*, mucous gland.

Fibroma.—*Fibromas of the ovary* constitute about 2 per cent of all ovarian tumours; they vary greatly both in their anatomical characters and in the symptoms to which they give rise. For purposes of description it is convenient to divide them into three classes—(1) fibroma in which the ovary is entirely replaced by the new formation; (2) fibroma in which the growth is localised to one part of the stroma, leaving the rest of the ovary unaffected except as the result of compression; (3) pedunculated fibroma. As most of the fibromata belong to the first group we propose to give a more detailed description of this class of tumour, and to point out briefly the characters which distinguish those of the second and third groups.

(1) *Fibroma in which the ovary is entirely replaced by the new formation* is frequently bilateral, though the growth on one side may have attained much greater proportions than that on the other. The tumours are seldom larger than a man's head, and even when of this size the general shape and contour of the ovary are preserved. The surface is smooth, with elevations and bosses here and there; dead white in colour, and remarkably free from peritoneal adhesions or inflammatory change. The tumours are found in the normal situation of the ovary, are pedunculated, and seldom (if ever) by their growth cause any appreciable separation of the two layers of the broad ligament. The Fallopian tube is not stretched over the surface, as is so commonly the case in cystoma, and shows no change beyond a slight degree of hypertrophy. The ovarian fimbria remains attached to the surface of the tumour.

The growths are of stony hardness, except where degenerative changes are present. On section they are composed of an interlacing net-work of white tendon-like, fibrous tissue. Microscopically the tumour consists of irregular spindle cells and fibrous tissue bands; the cells vary greatly in number in different parts of the growth. They are usually most abundant in tumours of small size, and in both form and arrangement are indistinguishable from the cells of the normal ovarian stroma. Vascular structures are few; they consist of capillary spaces lined with definite endothelium, around which the fibres are often arranged concentrically. Although true muscular walls are lacking the blood channels are developed to a far greater extent than in the sarcomata. Degenerative changes are common; myxomatous softening of the tissues may lead to the formation of cystic cavities in the interior of the tumour. Deposition of calcareous material is of rarer occurrence; hæmorrhages, dilatation of lymphatic spaces, and œdematous infiltration are also seen.

It is often an extremely difficult matter to differentiate these tumours from sarcomata. The ovarian stroma, composed as it is of spindle and round cells of varying characters and shapes, may be regarded as the physiological prototype of the sarcoma, and in the case of a tumour composed of similar elements histological diagnosis becomes a matter of great difficulty.

Many of these tumours are innocent, that is to say, after complete removal no recurrence has taken place in patients who have been under observation as long as sixteen and eighteen years; but we are sometimes disappointed to find rapid dissemination where histological examination reveals no definite evidence of malignancy; we have had two such cases under observation recently. As we shall point out later, more reliable information as to the innocent or malignant nature of the growth may often be obtained from the gross than from the microscopic characters.

Solid ovarian tumours are often accompanied by hydroperitoneum and sometimes by hydrothorax; this phenomenon has at present received no adequate explanation. It is a striking point that fibromyoma of the uterus, and even the encapsuled varieties of ovarian fibroma, very rarely lead to the accumulation of free fluid in the abdominal cavity, whilst with the growths under discussion ascites is the rule rather than the exception.

(2) The second group of ovarian fibromata has recently been studied by Fairbairn, who has revived a distinction originally enunciated over forty years ago by Virchow. He points out that in some cases we find, not an enlargement of the whole ovary, "but a solid tumour of a connective tissue type arising within the ovary, and leaving on its outer surface a variable quantity of ovarian tissue as a separate, distinct, and easily recognisable structure. Where a capsule to the growth can be made out it is continuous with the outer surface of the ovary, and is evidently formed from its tunica albuginea. In some cases the tumour can be separated all round from its ovarian bed, and enucleated from the ovary like a fibroid from the uterus."

The amount of ovarian tissue remaining depends upon the position in which the growth originates; when it arises towards one or other pole there is naturally more of the ovary left as an appendage to the tumour, whilst, if the growth begin in the more central part, the ovary will be thinned out, suffer more compression, and be less easily recognised. The ovary, or the remains of the ovarian stroma in the capsule, may show no changes beyond those due to compression, and may contain healthy ova. Clinically it is a matter of some importance to remember that the spot where ovarian tissue is most likely to be found is at the point of insertion of the ovarian ligament.

There can be no doubt that these tumours constitute a definite clinical and pathological variety; so far as we know at present they are invariably innocent, and are seldom or never accompanied by ascites.

(3) Tumours belonging to the third group of fibroma are of very rare occurrence; they are attached to the surface of the ovary by a distinct pedicle "like subserous myomata of the uterus." Such specimens have been described by Virchow, Doran, Keiffer, and others. Some are growths from the tunica albuginea, others have possibly undergone part of their development in the ovary, and become extruded from the surface. These different forms of ovarian fibromata do not represent stages in the growth of one variety, for no matter what size the tumour attains, the distinctive characters are still evident.

Ovarian fibroma is found at widely different periods of life; Beyea mentions an instance in a child of eight, but we have found no well-recorded case in which the patient was younger than twenty; several large tumours of this nature have been removed from women over seventy. The rate of growth is difficult to ascertain; it is, however, definitely known that four years may be occupied by a tumour in increasing from the size of a hen's egg to that of a man's head.

Adeno-Fibroma.—This rare tumour in general characters resembles those we have just described, but presents a more porous appearance, and contains cystic cavities lined by a definite epithelium consisting of cylindrical or low cubical cells. These adenomatous formations may undergo a colloid change, the epithelial cells degenerating, and the lumina containing a striated homogenous material. In other instances cancer may develop in them, the epithelial cells proliferating, assuming atypical forms, and invading the fibrous stroma. In these growths curious vesicular cells, somewhat resembling ova, are sometimes found (Orthmann).

The adenomatous structures probably originate either from inclusions of the germinal epithelium, or from the lining cells of the Graafian follicles.

Myoma and fibromyoma.—Both forms of tumour are rare, and probably have their origin in the ovarian ligament rather than in the ovary itself. Doran has described a pure myoma "the size of a small potato." We have never seen a specimen.

Fibromyoma is occasionally seen; the masses consist of smooth, interlacing muscular bundles separated from one another by loose connective tissue. If treated by van Giesson's stain the characteristic difference between the muscular and connective tissue elements is clearly displayed.

Carcinoma.—Primary carcinoma of the ovary occurs in two forms:—

(1) As a solid tumour; (2) as an intra-cystic growth arising in either the glandular or papillary tumours.

(1) The *solid* variety is rare; many cases described as primary carcinoma of the ovary, are instances of secondary deposits in this organ. The original growth is most often found in some part of the intestinal canal, or in the breast.

To the naked eye these tumours present a variety of forms: some are extremely hard and firm, others are much softer and almost brain-like, and possess a marked tendency towards degenerative changes. The tumours seldom attain a size greater than that of a man's head; they may be unilateral or bilateral, and frequently give rise to ascites. They are rounded and smooth in the earlier stages of their growth, for the tunica albuginea remains stretched over the surface as an investing capsule. As a rule the softer varieties grow more rapidly and occur in younger women; the harder tumours seldom attain a large size, and are found most often in women who have passed the menopause. On section-areas of fatty or caseous degeneration hæmorrhages and cyst-like cavities filled with a colloid material are common; the tissues are often pigmented, sometimes yellow, sometimes a dirty grey, and in places almost black.

The microscopic appearances are as diverse as the gross characters. Frequently sections cut from different parts of the same tumour differ widely from one another in structure. We have recently examined one specimen which in parts showed a typical carcinomatous arrangement, whilst sections prepared from another portion resembled much more closely sarcoma. In some instances the origin of the growth from the superficial epithelium can be demonstrated; gland-like invaginations occur into the stroma, these become cut off, the epithelial cells undergo irregular and atypical proliferation, and invade the surrounding tissue; in other cases the growth may possibly have its origin in the cells of the membrana granulosa. We usually find simple tubes lined by a single layer of columnar epithelium bounding a central lumen, the epithelium proliferates, and the tubes become closely packed together so that their lumina are filled with masses of atypical cells which are so tightly compressed that they lose their columnar shape and become spherical, cuboidal, or even squamous. In this way solid masses, cones, and nests are produced which present few of the characters of the parent cells. In the centre of these masses cavities are sometimes seen which contain fibrin and colloid material. Orthmann, Fothergill, and others have directed attention to the occasional presence in these tumours of large vesicular egg-like cells, with a nucleus resembling the germinal vesicle. By some pathologists the presence of these cells is taken to indicate the follicular origin of the tumour.

Solid ovarian carcinoma is seen at all ages; sometimes at or before puberty, most commonly between thirty and fifty, sometimes in women of advanced age.

(2) *Carcinoma originating in a cystic growth* is much the commoner form; it may occur in cysts of either the glandular or papillary type. As we have already stated, the latter group of tumours stands upon the border line of malignancy, and it is not surprising that its members should sometimes exhibit the characters of true carcinoma.

The carcinoma preserves the form and shape of the cyst in which it originates. The contents of the loculi may be clear, or from the large quantity of cells mixed with the fluid may resemble pus; if hæmorrhages have occurred different degrees of pigmentation are seen. As the malignant growth progresses the cyst wall is perforated, the cancer spreads to adjacent organs, and metastases are found in various parts of the abdominal cavity.

Carcinoma developing in glandular cysts arise from an atypical proliferation of the cyst epithelium; the columnar cells lining the carcinomatous alveoli become stratified, or form proliferating masses which project into the gland lumina sometimes to such an extent as to obliterate them altogether; at the same time they invade the connective tissue stroma of the wall and the septa of the loculi in the form of masses and nests of cells which destroy and replace the tissues as they advance. In the papillary cysts a similar series of changes occurs, the epithelium covering the papillæ actively proliferates, becomes atypical, polymorphous, and many layered; it grows inward towards the cavity and outwards to invade the papillæ and cyst wall. The psammoma bodies already described in connection with the innocent cysts are frequently found also in the malignant variety.

True metastases by the blood and lymph streams do not, as a rule, occur early in ovarian carcinoma, dissemination by transplantation of portions of growth to distant parts of the peritoneal cavity is, on the contrary, common. The growth usually invades, first, the peritoneum and cellular tissue in the region of its site of origin; the Fallopian tubes, the mesentery, and more distant parts of the abdominal cavity are often infected, whilst more rarely metastases occur in the retroperitoneal glands, the liver, and lungs.

Secondary carcinoma of the ovary is not of very frequent occurrence. Out of eighty-one autopsies upon women dead of cancer Coupland records only nine instances of secondary deposits in the ovary, but judging from our own experience, had microscopic examinations of all cases been made the number would probably have been much greater. They are most commonly seen in cancer affecting the intestinal tract, the uterus, and the breast; in structure the secondary deposits usually bear a close resemblance to the primary growth.

Sarcoma.—Sarcoma of the ovary is commoner than carcinoma; reliable statistics as to its frequency are not easy to obtain, but in 1902 Stander published a careful study of a series of cases; he found that between the years 1889 and 1901, 295 cases of ovarian tumour were operated upon in the clinic at Würzburg; of these, twenty proved to be sarcoma, six of which were of the type of endothelioma. Thus in this particular hospital 6·7 per cent of all ovarian tumours removed during a period of thirteen years were sarcomata.

The growths may be unilateral or bilateral, the former constituting about 60 per cent, and the latter about 40 per cent of the total cases. The two ovaries may be affected simultaneously, or a considerable period may elapse before the second ovary shows signs of disease. They usually give rise to ascites and sometimes also to hydrothorax. The tumours are pedunculated, rounded, or oval in shape; their surface may be smooth or nodular; the separate nodules are sometimes connected to the main mass by narrow pedicles; they possess no distinct capsule. In consistency they vary greatly; those of the spindle-celled variety are firm and hard, resembling in their general characters the fibromata. The round-celled sarcomata, on the contrary, are softer and more brain-like, sometimes pigmented, and show on section hæmorrhages into the tissues, areas of softening, and cyst-like cavities.

It must be remembered that mixed forms are found, that in both varieties the relative amounts of cellular and fibrous tissues vary greatly, and that in either form myxomatous degeneration with subsequent softening may occur. Melanotic sarcoma is not uncommon in the form of secondary deposits. Andrews has recorded one case in which the ovary was apparently the only seat of the disease.

Histologically the round-celled sarcomata are very vascular tumours. They consist of closely packed, small, round cells with relatively large nuclei, which stain deeply and are surrounded by clear protoplasm. These cells are separated from one another by a delicate intercellular stroma, which is sometimes arranged round groups of cells in such a manner as to give them an alveolar appearance. Not infrequently lymphatic vessels crowded with round cells are found in the stroma of the tumour; sometimes on the peritoneal surface layers of sarcoma cells are seen. They are very malignant, rapidly cause metastases, and in general arise early in life.

The spindle-celled sarcomata are characterised by the much greater amount of fibrous tissue which they contain; this is present in the form of interlacing strands and bundles, between which lie groups of spindle cells with nuclei, varying greatly in size and form, rich in chromatin contents. The difficulty of distinguishing sections of these tumours from the normal ovarian stroma and from the fibroma has already been mentioned; they may, however, be recognised to a certain extent by the great variety in form and size of the nuclei, and by the fact that the cells are found lying together in groups, often in the nighbourhood of lymphatic vessels. They are less malignant than the softer round-celled variety, and usually occur in older women.

Endothelioma and Perithelioma are rare varieties of sarcoma in which the malignant growth arises in the walls of blood or lymphatic vessels, either from the cells of the endothelial lining or of the adventitia.

The tumour may be entirely solid or partially cystic; its consistence may be soft or firm, its surface may be smooth or nodular. Sometimes the tumours are unilateral, sometimes bilateral, and occasionally are combined with other growths—cysts or embryomata. They are very malignant, and after removal recurrence or dissemination takes place rapidly. Microscopically, the endotheliomata are composed of cells resembling those of the endothelial lining of blood or lymph vessels; the malignant cells become cubical, spheroidal, or squamous in form, and large multinucleated giant cells are sometimes seen. Cell columns grow out into the surrounding connective tissue in the form of tubular and cone-like masses. This mode of growth gives a distinctly alveolar appearance to the microscopic sections. In the later stages proliferation has occurred so rapidly that the alveolar structure is lost, and the typical picture of a round-celled sarcoma is produced.

Perithelioma arises from the adventitia of the blood-vessels or from the perivascular lymphatics; the vessel becomes surrounded by a mass of small round cells, which encroach upon its lumen and invade the surrounding connective tissue. Many vessels are simultaneously affected so that rounded masses of cells are produced, separated from one another by strands of connective tissue, which are ultimately invaded and destroyed. Both groups of tumours commonly undergo degenerative changes—necrotic and myxomatous.

In addition to the above varieties, it must be remembered that sarcomatous tissue may be found in the walls of ovarian cysts of adenomatous, papillary, or embryonal nature. Ovarian sarcomata are seen at all periods of life. Doran has described one in a seven months' fœtus. They constitute probably about 30 per cent of all ovarian tumours occurring in girls under fifteen, and in these young subjects are usually of the round-celled variety and intensely malignant. In older patients the spindle-celled type is commoner, the fibrous stroma is more marked, and the malignancy is not so great.

Metastases are common; the lumbar glands, the liver, and the lungs are the commonest sites.

Broad ligament cysts.—Under this name we include a number of cyst formations found between the two layers of the broad ligament, and having their origin in structures other than the ovary. The majority of these tumours arise from the parovarium or organ of Rosenmüller, a vestigial remnant of the mesonephros and Wolffian duct. All broad ligament cysts, however, are not Wolffian in origin. We distinguish two other varieties—(1) hydrosalpinx of an accessory Fallopian tube; (2) small cystic tumours formed by dilatation of subperitoneal lymphatics.

Parovarian cysts develop from Gartner's duct or from the vertical tubules of the organ of Rosenmüller. They may measure only a few millimetres in diameter, or may form enormous tumours, occupying the greater part of the abdominal cavity; small parovarian cysts are sometimes multiple, large ones are invariably single. They are smooth, transparent, thin-walled, and only loosely united to the enveloping peritoneum. Their pedicle is much broader and less distinct than that of an ovarian tumour, and they not infrequently burrow deeply into the tissues of the pelvic floor, sometimes displacing the uterus or stripping up the peritoneum from the abdominal walls.

The relations of the tube and ovary are characteristic; the tube is arched over the upper surface of the tumour, and may be greatly elongated; the fimbriæ remain attached to the cyst, but are flattened and spread out. The ovary is usually separate and distinct, but is sometimes seen as a flattened prominence on the wall of the cyst.

The inner wall is generally smooth, but it is not uncommon to find numerous small warty protuberances scattered over it (papillary fibroma); much more rarely slender branching processes and cauliflower-like masses are seen (parovarian papillary cystadenoma). The contained fluid is thin, pale, and limpid, of specific gravity 1·004 to 1·006, alkaline in reaction, poor in albumen.

Microscopically the cyst wall is composed of a loose-meshed connective tissue containing unstriped muscle fibres, and lined by a single layer of columnar ciliated epithelial cells resting upon a basement membrane. According to Orth, no matter how large the cyst, columnar ciliated epithelium can be demonstrated upon some part of its wall. It will be remembered that the hilum of the ovary is penetrated for a variable distance by the tubules of the parovarium. From these tubules hilum cysts possessing all the characters we have just described may develop. The theory that papillary cysts of the ovary arise from the hilum only is contrary to observed facts.

Parovarian cysts grow slowly, and may exist for so long as ten years before serious pressure symptoms arise. It is doubtful if they develop before puberty.

Hydrosalpinx of an accessory Fallopian tube was originally described by Kossman. This subject has been recently investigated by Handley, who has shown that a specimen of broad ligament cyst in the Royal College of Surgeons' Museum is a hydrosalpinx of an accessory tube. In the walls of this cyst were plicæ and sub-plical spaces identical with those found in an ordinary hydrosalpinx, and the cavity of the cyst communicated directly with the lumen of the Fallopian tube. These tumours may have a clinical as well as a pathological significance. In 1903 Cullingworth removed by operation a hydrosalpinx of an accessory Fallopian tube which measured 2¾ inches in diameter and had caused considerable pain.

Small cysts formed by dilated lymphatics are common on the surface of the tube in cases of pelvic inflammation. They seldom attain any considerable size or give rise to symptoms. Howard Kelly figures a cyst of this nature as large as a golf-ball.

To complete the list of broad ligament cysts it is necessary to mention the hydatid of Morgagni. This small pedunculated body, whose origin is still somewhat doubtful, may be the seat of cystic change. It seldom attains a size larger than a walnut, and, as far as we know, is of no clinical importance.

The Natural Progress of Ovarian Tumours.—The majority of ovarian tumours belong to the group of proliferating cysts, and grow much more rapidly in their advanced stages than ovarian "dermoids," or than solid tumours of either uterus or ovaries, provided such tumours are not malignant. They are usually pedunculated, and for this reason their position in the abdomen varies.

We possess little knowledge of the earlier stages of their development, for it is only occasionally and almost by accident that small ovarian tumours are discovered, and not infrequently they attain a large size before the patient seeks medical advice. In the earlier stages of the proliferating cysts the rate of growth is probably slower than in the later; in the case of "dermoids" and benign solid tumours it is slow throughout. Growth so rapid that an increase in size can be detected from day to day is the result of hæmorrhage into a cyst. If the uterus and broad ligaments are in their normal position, the ovary enlarged by cystic disease lies at first in its usual place in one or other posterior quarter of the pelvis, or becomes prolapsed and occupies the retro-uterine pouch of peritoneum. As it increases in bulk the tumour rarely remains in the pelvis, but rises in the direction of least resistance, and, displacing the bowels, gradually comes into contact with the anterior abdominal wall, and tends to assume a more central position. The pedicle, formed by the Fallopian tube and broad ligament, lies at first in front of and below the tumour. When the tumour has risen out of the pelvis its pedicle lies directly below or sometimes posterior to it. In this position the tumour is supported by the brim of the pelvis, causing little or no discomfort to the patient, and, if the pedicle be long enough, no displacement of the uterus. Impaction of the tumour in the pelvis occurs occasionally, either from irregularity in enlargement of component cysts, or from the formation of adhesions. In these cases the uterus is pushed forward, and lies close behind the symphysis pubis. If the tumour occupy the utero-vesical pouch of peritoneum, the uterus will be displaced backwards and retroverted; but should the tumour burrow between the two layers of the broad ligament, or should the broad ligament be dragged up in front of the tumour by a short pedicle, the uterus will be displaced laterally. Such displacements of the uterus add greatly to the difficulties of diagnosis. When the tumour is once completely above the pelvic brim its further enlargement usually leads to a gradually increasing distension of the abdomen; as in the case of the pregnant uterus, the bowels are displaced upwards and pushed aside. At this stage the tumour is generally recognised and removed; but, if it continue to increase, the enlargement of the abdomen becomes very great, the diaphragm is forced upwards, the lower part of the thorax becomes expanded, and severe pressure symptoms result. In such cases the effects of pressure upon the organs of respiration, circulation, and digestion become so marked that the consequent suffering and emaciation of the patient lead to a characteristic facial expression, not rarely seen in former days, when, owing to its great mortality, the operation of ovariotomy was usually postponed as long as possible.

Doran has drawn attention to the frequency of dilatation of the ureters, with chronic interstitial changes in the kidneys in cases fatal after operation. He believes that such changes result from the pressure of the tumour.

The development of ovarian tumours does not, as a rule, interfere with ovulation and menstruation. Although both ovaries may be the seat of tumour formations, so long as healthy ovarian tissue remains, these functions may be unaffected. Thornton has recorded a case of pregnancy with bilateral dermoid cysts, the remains of ovarian tissue being indicated by the presence of a corpus luteum in the wall of one cyst. Amenorrhœa may sometimes occur from the great deterioration of the general health produced by the size and pressure effects of the tumour, or by its malignancy. In the case of solid tumours, which are frequently bilateral, amenorrhœa, if present, may be due to the total destruction of Graafian follicles which usually occurs in these cases.

Complications.—Cystic tumours occasionally cause hydroperitoneum, solid tumours frequently. The reason for this difference is not known, nor is it known why solid tumours of the ovary should give rise to this condition when similar tumours of the uterus do not. If much free fluid be found associated with a cystic tumour, it is most likely to be due (in the absence of surface or perforating papilloma, or other extraneous causes) to leakage from one or more of the cyst loculi into the peritoneal sac. It is sometimes due to pressure by the cyst upon the vena cava and other great abdominal veins. In the same way œdema of one or both legs may occur, and in rare cases distension of the ureters and renal pelves.

The most frequent complication is the formation of adhesions to adjacent structures: to the omentum and intestine, oviduct, uterus, bladder, and abdominal wall. Such adhesions may be the result of acute inflammation of the cyst, leading to local peritonitis (a complication to be next described); or they may arise passively and painlessly, without any symptoms to alarm the patient, or even to interfere with her usual occupation. A possible explanation of this occurrence is that the epithelium covering the cyst wall in its earlier stages may be removed by friction, and fibrinous exudation then occur, leading to the formation of adhesions between adjacent surfaces. Such adhesions may be extensive, or merely thread-like and easily broken down; sometimes (especially when connected with the omentum) they may contain vessels so large as to become an important source of blood-supply to the tumour. Dermoids are more frequently complicated by adhesions than are other tumours. Cysts of the ovary adherent to the bladder or rectum may form communications with either viscus, and, in the case of dermoid cysts especially, with curious results: a lock of hair may be found protruding from the urethra or anus; or bones, teeth, and other contents of these cysts be evacuated. Tubo-ovarian cysts usually arise in this manner; they are described on page 430.

The chief importance of adhesions is that they render operation more difficult; in some cases, indeed, the operator has great difficulty in determining whether he is dealing with the parietal peritoneum, the cyst wall, or some adherent viscus.

Acute inflammation of cysts.—This is usually a spontaneous complication. In the pre-antiseptic period it was a common result of tapping the cyst for the purpose of diagnosis or treatment, and (together with septic peritonitis) was not uncommonly one of the causes of the death of the patient. Apart from this, inflammation occurs most frequently in conditions which interfere with the vitality of the tumour; such are acute torsion of the pedicle and injury by pressure, particularly during labour. The pyogenic organisms probably enter from the intestinal canal, and lead to suppuration. It is probable, also, that an acutely inflamed Fallopian tube, adherent to a cyst, may lead to its infection without the formation of a true tubo-ovarian abscess.

Torsion of the pedicle.—This complication, when acute, is one of great importance; for, unless recognised and dealt with by operation without delay, the danger to life is very great. A slight degree of torsion (quarter of a circle) is a common occurrence, and is probably due to the change of position which a small tumour undergoes as it rises from the posterior surface of the broad ligament to a position of greater mobility above the pelvic brim. This slight degree of torsion does not necessarily produce symptoms, and is probably persistent.

Under certain conditions, such as forcible contractions of the abdominal muscles, movements of the intestines, or unequal enlargement of some of the component loculi, this slight torsion becomes increased gradually or suddenly, with results which vary with the suddenness and degree of the strangulation. When the torsion is slow and gradual the circulation is obstructed slowly; as a result, the growth of the tumour may be arrested. In rare cases atrophy of the twisted pedicle is so complete that the tumour becomes more or less separated from its original attachment; its vitality may then be maintained by a blood-supply obtained from the adherent viscera, most commonly from the omentum. If no such adhesions exist the tumour lies free, or almost free, in the peritoneal cavity, and gives rise to considerable ascites. Acute torsion is a far more serious matter. The sudden interference with the return of blood from the cyst frequently leads to hæmorrhage into its cavity, and consequently to rapid enlargement. The abdomen becomes very tender, and the condition is comparable to cases of moderately acute latent accidental hæmorrhage in advanced pregnancy. I have seen a case in which, in a young patient, torsion of the pedicle led to severe hæmorrhage into the cyst; as a consequence of this accident it ruptured into the peritoneal cavity, which filled with blood. The symptoms were very urgent. The patient, however, made an excellent recovery.

In other cases strangulation of the pedicle interferes with the vitality of the tumour, and allows it to be rapidly invaded by septic micro-organisms, such invasion resulting in an acute inflammation of the cyst and peritoneum which necessitates immediate operation.

Herman W. Freund has discussed the mechanism of torsion of the pedicle, and has suggested the law that right-sided tumours rotate to the left, and left-sided tumours to the right; he admits, however, that there are many exceptions to this law. Professor A. R. Simpson has also illustrated the same law by three instances. Freund quotes ten cases: in six only was the pedicle twisted; in four the rotation was to the right, and in two to the left. Of the four which rotated to the right, two were tumours of the right ovary and two of the left; and of the two which rotated to the left, one was a tumour of the right ovary and the other of the left. Out of sixty-six cases of ovariotomy at St. Bartholomew's Hospital, between August 1892 and October 1894, there were fifteen cases of torsion of the pedicle of ovarian cysts, and one of a broad ligament cyst Of ten left-sided tumours, six were twisted in the opposite direction to the movements of the hands of a watch, that is, from right to left; and four in the same direction as the movement of the hands, that is, from left to right. Of five right-sided tumours, three were twisted from left to right, and two from right to left. These numbers are not large enough to decide the question of Freund's "law"; but they suggest that the direction of rotation does not present a constant relation to the side from which the tumour arises.

Incarceration of ovarian tumours in the pelvis.—This is a rare complication; but it is found occasionally in the case of tumours which invade the broad ligament, and which, having no pedicle, are greatly restricted in their mobility. Still more rarely a pedunculated ovarian tumour (particularly when fixed by adhesions) may become incarcerated in the retro-uterine pouch of the pelvic peritoneum, giving rise to retention of urine, a condition far commoner with uterine fibroids or pelvic hæmatocele. In St. Bartholomew's Hospital Museum is a rare specimen (No. 2951C) of a dermoid cyst adherent to the uterus, and causing retention of urine. Before admission the retention was unrelieved, owing to the common mistake of not recognising that constant dribbling of urine is often a symptom of extreme distention of the bladder.

Rupture of cystic tumours.—This occurs in three forms: (*a*) Rupture of a thin-walled unilocular cyst, leading to a sudden disappearance of the tumour, and to the presence of free fluid in the peritoneal cavity: in these cases the cyst usually fills again. (*b*) The rupture of one or more loculi of a multilocular cyst with constant leakage into the peritoneal cavity, leading to the presence of a cystic tumour with free fluid. (*c*) The perforation or rupture of a cyst or parts of a cyst containing papillomata, followed by the detachment and escape of particles and the spread of the growth over adjacent parts. The rupture may occur spontaneously during a medical examination, or in consequence of injuries such as falls or blows. If the contents of the cyst are aseptic, as is usually the case, the immediate effects are slight. Unless hæmorrhage occur, there is, as a rule, little pain or shock; sometimes these symptoms are well marked, for large veins in the capsule of the cyst may be torn across. The tumour, of course, disappears, and occasionally does not re-form. The fluid, if thin, is rapidly absorbed by the peritoneum and excreted by the kidneys; under these circumstances polyuria may persist for some days. If the fluid be viscid it accumulates as the cyst continues to leak; gradually it occupies all the peritoneal spaces between the bowels, and even the more distant parts between the liver and the diaphragm, so that it is very difficult to remove it entirely at the time of operation.

A case of infection of the peritoneum with dermoid growths after rupture of the primary tumour has already been mentioned; and the spread of papillomatous growths in this way is well known. Such secondary growths are benign, and after removal of the main cyst shrivel and disappear.

Pregnancy and labour complicated by ovarian tumours.—Ovarian tumours form a very important complication of pregnancy and labour. The difficulty during pregnancy is in the diagnosis, not in the treatment. Experience shows that ovarian tumours may be safely removed at any period of pregnancy, and should be removed as soon as diagnosed.

Labour may be complicated by the presence of an ovarian tumour in the abdomen or in the pelvis. In the abdomen tumours may be of considerable size without doing much harm; but if even a small tumour occupy the utero-sacral pouch of the pelvis it will cause obstruction, and must be dealt with. Most of these are cystic tumours; but a case of fibroma of the ovary has been recorded by one of us, which, during labour, simulated the head of a second extra-uterine fœtus. Cystic tumours have been driven down by the advancing fœtal head, and have ruptured the posterior vaginal wall, so that the tumour has been spontaneously delivered before the fœtus.

Sometimes it is possible, especially during the earlier stages of labour, under deep anæsthesia, to raise the tumour above the pelvic brim, and so out of the way of the presenting part. When the obstructing tumour is a thin-walled cyst, simple puncture through the posterior vaginal wall may be the best method of dealing with it for the time. When the bulk of the tumour cannot be sufficiently diminished owing to its multilocular character, or when the tumour is solid, there can be no doubt that cœliotomy and removal of the tumour, followed, in certain cases, by Cæsarean section, is preferable to dragging the fœtus past the obstructing mass. When this latter course is adopted the tumour is usually so damaged that afterwards it becomes acutely inflamed, and the patient is placed in very great danger.

Diagnosis.—*Ovarian and Broad Ligament Tumours.*—The diagnosis of ovarian tumours rests upon the recognition of their physical characters, for there are no symptoms of diagnostic value. The abdominal enlargement which attracts the patient's attention is generally her only complaint. Still, this very absence of symptoms, coupled with progressive enlargement of the abdomen, is of value in the investigation of the case and in the endeavour to set aside other abdominal diseases. It does not require a very large experience to convince us that, as Matthews Duncan said, until the abdomen is opened and the tumour exposed, the diagnosis of such cases is not one of scientific precision, but rather of a great probability, amounting, no doubt, in very many cases to practical certainty. In addition, personal recollection of mistakes will make the physician cautious, even in cases that appear to be simple, and still more so when they present unusual characters. In the large majority of cases, so long as the patient's health is not seriously affected and the uterus is healthy, menstruation and ovulation are unaffected by the disease. Interference with ovulation is of much more frequent occurrence in the case of the rare solid tumours than it is in cystic tumours. Too much stress has been laid by some authors on a tendency to amenorrhœa as a symptom of ovarian cystoma. It is far more correct to say that the absence of amenorrhœa or other menstrual derangements is the symptom of importance. That is to say, if a woman has an abdominal tumour of pelvic origin, and the menstrual function remain normal, this is, in itself, a point of diagnostic value in favour of the ovarian origin of the tumour, and as a symptom must be considered of equal value with the amenorrhœa of pregnancy or the menorrhagia of uterine fibroids.

In 118 consecutive cases operated on in the "Martha" ward at St. Bartholomew's Hospital up to March 1895, 20 cases were in patients either before puberty or after the menopause; of the remaining 98, in 73 menstruation was normal; in 7 there was amenorrhœa for short periods (3-12 months); in 3 the menstrual flow was lessened in quantity; in 3 menorrhagia was present; in 4 the daily loss was increased in quantity, but the health was not thereby affected; in 8 menstruation was quite irregular as regards both time and quantity. These figures show that in about 75 per cent of cases of ovarian tumour there is no change in the character of the menstrual period during the twelve months preceding the diagnosis of the tumour; and that in the remaining cases increased loss is nearly as frequent as diminished loss. But in these cases of altered menstruation the possibility of a uterine cause must be borne in mind before the disturbance is assigned to the presence of the ovarian tumour.

Pain is an unusual symptom in cases uncomplicated by impaction, inflammation, or strangulation; and the pressure effects are usually not attended by much discomfort until the tumour has attained a considerable size. In rare cases the increase of general intra-abdominal pressure due to the presence of the tumour is the immediate cause of procidentia uteri, even in nulliparous women. We have seen two such cases in neither of which was the tumour impacted.

Matthews Duncan, in his Clinical Lectures, says with regard to the diagnosis of ovarian cystoma: "You get no aid from symptoms. Frequently there are, and have been, no symptoms; the case comes before you solely on account of size, or you may accidentally discover the tumour. Sometimes there are symptoms which may be described as resembling those of advancing pregnancy; only instead of the mammary and clavicular fat increasing, as they generally do in pregnancy, you have them generally diminishing. Sometimes you have disturbance of menstruation. Sometimes you have a history of severe pain in the womb, or in one or the other ovarian region. Sometimes you are told the swelling began on one side. But all these indications vary much, and however they may be combined they form no basis for a diagnosis."

The first stage in the diagnosis of ovarian tumour is obviously the recognition of an abdominal or pelvic tumour. The second is the identification of the tumour as ovarian, partly by the recognition of its physical characters, partly by exclusion of other kinds of tumour. Both of these stages present difficulties, sometimes so great that nothing short of an exploratory opening of the abdomen is sufficient to determine the diagnosis; and there are cases of such obscurity that even this operation, in the hands of an experienced operator, followed by more or less complete evacuation of the contents of some cavity, may prove insufficient to determine the exact nature and origin of the tumour.

In the first place, let it be certain that the bladder is empty, using the catheter if there be any doubt on this point. It would be easy to quote examples of mistakes made, not by beginners only, from neglect of this simple precaution. Almost equally important is the clearing out of the bowels; for fæcal masses are not infrequently mistaken for abdominal tumours. Next, and this is of first importance, let it be always assumed that a woman—who is of the child-bearing age, and whose menstruation has been absent for a period of from one to twelve months—is pregnant, until absolute proof to the contrary be obtained. Mistakes in connection with pregnancy are the most common and the least excusable of any. How often do we meet with cases in which a pregnant uterus is diagnosed to be an ovarian cyst? And how often is a woman or girl suspected of pregnancy, sometimes even accused of it, when it is her misfortune to suffer from an ovarian tumour?

The diagnosis of intra- or extra-uterine pregnancy when the fœtus is dead, of pregnancy with hydramnion, or complicated with ovarian or other tumours of considerable size, is often difficult enough; but that of normal pregnancy, advanced to such a size as to form an abdominal tumour, is simple if the examination be systematic. This is not the place to go fully into the diagnosis of pregnancy; but it may be mentioned that the easiest way of diagnosing this condition beyond the fifth month (that is, with the fundus above the navel) is by palpation of the abdomen, when the hand may recognise parts of the fœtus floating in fluid, and some of them may present spontaneous movements. Next, in every case of obscurity let the patient be put under an anæsthetic, and when muscular relaxation is complete, repeat the examination of the abdomen and pelvis. The general condition of the abdomen, fluctuation, and the area, site, and limits of the supposed tumour, become far clearer when the abdomen is well relaxed; hence the aid of an anæsthetic is often invaluable.

Recognition of abdominal tumours.—This involves the recollection and the exclusion of conditions which simulate abdominal tumours; namely, enlargement of the abdomen by accumulation of fat in its walls and within it; distention by flatulent bowel and by fæcal masses; ascites; and coils of bowel matted together by adhesions, with or without much fluid effusion. Of these, certain cases of localised effusions and cases of chronic peritonitis are apt to give rise to the greatest difficulties of diagnosis.

An ovarian tumour has usually a well-defined outline above and at the sides; it is often irregular, not rarely nearly spherical; usually there is a distinct feeling of fluid within it, with well-marked fluctuation in parts, if not in the whole mass. The presence of fluctuation in all directions and over the whole area of an abdominal tumour proves the continuity of the fluid and the practically unilocular nature of the cyst; but this may be closely simulated by a solid tumour in front of which lies a layer of free fluid.

Hard masses felt in an otherwise cystic tumour usually indicate secondary cysts, which, when small, are usually very tense and feel solid; they have no tendency to ballottement, and do not present spontaneous movements as do parts of a fœtus in utero. There is dulness on percussion over its whole surface, except perhaps at the margins, where the bowel distended with gas may overlap it, or by contact give a false impression of resonance.

No pain is caused by palpation unless strangulation or inflammation of the tumour, or considerable hæmorrhage into it, has occurred. An ovarian tumour is usually dumb, and no souffle audible as is frequently the case with all kinds of uterine tumour; but pulsation sounds communicated from the great abdominal vessels may be heard and are of no importance.

The recognition of these features will enable us to exclude all the ordinary conditions simulating abdominal tumours. There is no defined tumour, dull on percussion, produced by accumulation of fat or by distended flatulent bowels; and fæcal masses are more likely to be overlooked than to be mistaken for ovarian tumours. I have already referred to the paramount necessity of clearing the bowels and emptying the bladder before attempting to make a diagnosis.

Hydroperitoneum (*Ascites*).—It is only under exceptional circumstances that a passive hydroperitoneum is difficult to distinguish from ovarian tumours. Hydroperitoneum may be present with any form of abdominal tumour; or if one or more parts of a ruptured cystic tumour continue to leak into the peritoneal cavity, a condition of tumour with free fluid may be produced. In such cases the tumour will usually be felt, and the presence of free fluid ascertained with equal certainty. But the most puzzling and unexpected cases are those in which a passive serous effusion takes place, perhaps to the extent of several pints; and in which the fluid, instead of sinking to the most dependent parts, is confined to the centre of the abdomen, in a kind of sac formed by the coils of intestine tightly pressed together or slightly adherent. The physical characters of such a collection are not distinguishable from those of a thin-walled unilocular cyst. Two such cases occurred in succession in my own practice, and both were mistaken for ovarian cysts.

Collections of fluid in the peritoneal cavity in connection with chronic tuberculous peritonitis are frequently met with, but as a rule a "tumour" thus formed will be resonant on percussion over a large part of its area, and will be accompanied by other signs of evident illness; the temperature will usually be found distinctly raised at night—a symptom of the highest importance.

The last class of false abdominal tumours contains those formed from matted coils of intestine and omentum, with more or less fluid in the interstices, whether serum or pus. Such masses are produced in connection with inflammations of the vermiform appendix, or of the ovaries and oviducts; and these, from their close proximity and frequent adhesion to the uterus, are liable to be mistaken for uterine fibroids.

Diagnosis of pelvic tumours.—To recognise the presence of a pelvic tumour, and further to be able to identify its nature, is a far more difficult matter than in the case of most abdominal tumours. It requires not only an intimate knowledge of the subject, but a greater experience in the practical application of that knowledge than most practitioners are able to obtain. We have here first to deal with the recognition of a tumour.

A pelvic tumour, for simple anatomical reasons, is most likely to occupy that part of the pelvic cavity which lies above and behind the uterus and broad ligaments. This space in health is occupied by coils of small intestine, which are very easily displaced from it, and varies in size with the varying distention of the bladder and rectum. Normally the utero-vesical pouch is merely a linear cavity, the uterus and broad ligaments resting directly on the bladder. This linear cavity is at once opened up and admits coils of small intestine when the uterus and broad ligaments are retroverted, and under such conditions is, of course, most open when the bladder is empty. A pelvic tumour can be recognised in either of these cavities only by a bimanual examination; and the emptying of bladder and rectum, and the use of an anæsthetic, are of as great importance in this examination as in the case of abdominal tumours.

A tumour may be so small as to lead to no appreciable displacement of the uterus; such are the rare tumours of the round ligaments of the uterus, the common small enlargement of the ovaries and tubes, and small uterine fibroids. But, as a rule, the tumour, according to its position and size, will be found to displace the uterus more or less to the opposite side if lateral to the uterus, forwards if behind it, backwards if in front of it.

The first suspicion of the presence of a pelvic tumour usually arises during a vaginal examination. The cervix is first identified either in a normal position or displaced laterally, anteriorly, posteriorly, upwards or downwards; and careful palpation reveals a convex swelling behind, in front, or on one or on both sides of it. The next stage is to ascertain that the convex swelling is part of the surface of a more or less spherical tumour, not something simulating one. The conditions most likely to simulate a tumour are :—(1) The body of the uterus felt, as it is normally, through the anterior fornix, or felt more readily than normally because anteflexed or because of an increase of its anteversion; or felt on one side of the cervix from lateral displacement, or through the posterior fornix from retroversion or retroflexion; (2) the bladder more or less distended, or the rectum loaded with fæces; (3) inflammatory thickening of the peritoneum or cellular tissue. The diagnosis of the conditions in group 2 is so easily determined by the use of the catheter, and by digital examination of the rectum, that it is not necessary to allude to it further; but adhesions, the result of perimetritis or parametritis, require careful examination. In the first place, simple adhesions usually draw the uterus to the affected side, and by bimanual examination are found to have little thickness; the two hands may meet, and the absence of a "tumour" is then clear. If there be much effusion—of pus, blood, or serum—into either the cellular tissue or peritoneum, a definite tumour is formed and the uterus is displaced from its normal position. If, by a bimanual examination, the abdominal hand finds a convex surface projecting into or above the pelvic inlet, and corresponding with that discovered by the finger in the vagina, the presence of a "tumour" is then clear, and we proceed to ascertain its nature. The first step is to determine whether the tumour is or is not the body of the uterus enlarged by pregnancy, or by such diseases as produce uniform increase in size—certain fibroids, cancer of the body, pyometra, hæmatometra, and hydrometra.

Here, as in the case of abdominal tumours, to set aside pregnancy is of the first importance, and is a task by no means always easy even to the experienced physician. It must not be forgotten that pregnancy at any stage may be complicated by the presence of a tumour. The diagnosis of the pathological enlargements of the body of the uterus is given elsewhere. The difficult bimanual examination is of the greatest importance. If pregnancy be certainly excluded, the uterine sound passed up to the fundus is of the greatest value, for it not only determines the length of the uterine cavity (a detail of great value in distinguishing uterine from non-uterine pelvic and abdominal tumours), but it identifies the relative positions of the uterus and of tumours lying close to it in cases in which a bimanual examination has failed to do so. The difficulties which are met with in passing the sound to the fundus, however, lead sometimes to mistakes in both these particulars, and to incorrect inferences.

Having now excluded or recognised enlargement of the body of the uterus, and determined that there is a tumour adjacent to it, we proceed to consider one by one the different forms of tumour which may be present. Before proceeding further it will be well to return to the consideration of abdominal tumours that we may make a preliminary selection of them, for pelvic and abdominal tumours have many points in common. It must be borne in mind that even when arising from such distant organs as the kidney or spleen, abdominal tumours may lie partially within the pelvis. We must also bear in mind that while tumours contained in the pelvis are almost invariably of pelvic origin, abdominal tumours which lie entirely above the brim of the pelvis may have originated either in the pelvic or in the abdominal organs; and that tumours that lie partly in the abdomen and partly in the pelvis, while usually of pelvic origin, may have arisen primarily in an abdominal organ, and have descended later into the pelvis.

Diagnosis of the site of origin of an abdominal tumour.—It is not necessary to discuss all possible sites for every variety of abdominal tumour. We begin with the assumption that the tumour before us is so situated in the abdominal cavity that a pelvic connection is not altogether improbable; thus we exclude at once such tumours as those of the pylorus. Now such a tumour may arise in the pelvic, renal, splenic, hepatic, and central (mesenteric and omental) regions. A tumour of pelvic origin can be traced down to the pelvic brim, as the physician stands by the side of the patient and looks towards her feet, with his hands placed on her abdomen and his fingers directed downwards to the pelvis; there will be no area of resonance between the prominent part of the abdominal tumour and the pelvic brim, because the tumour, as it arose out of the pelvis, will have displaced the intestine in much the same way as a gravid uterus does, and will lie in contact with the abdominal wall. A small tumour of pelvic origin lying above the pelvic brim is usually very freely movable, and may therefore be found sometimes on one side, sometimes on the other; but if it be found constantly on one side, this will indicate with great probability the side from which it sprung. Large tumours accommodate themselves with greater difficulty to the abdominal cavity; they are more centrally placed, and their mobility is much more restricted.

Many tumours arising from the kidneys are easily identified. A renal tumour is often confined to one-half of the abdominal cavity, and can be traced by bimanual palpation (one hand on the abdominal surface of the tumour, the other on the loin) into the region of the kidney. A large fluctuating hydronephrosis, extending well across the middle line of the abdomen, and so far down into the cavity of the pelvis as to be reached by vaginal examination, may very easily be mistaken for an ovarian cyst.

The only tumours of the liver likely to be mistaken for tumours of the ovary are hydatids. These are notoriously deceptive; but as a rule their connection with the liver can be traced, and an area of resonance between the tumour and the pelvis can be detected.

The spleen, dislocated and greatly enlarged, may sink down to the pelvis and be mistaken for an ovarian tumour. Mr. Meredith operated on such a tumour, which, both by himself and by the writer, was believed to be of ovarian origin. It occupied the utero-vesical pouch, and rose nearly to the navel. On opening the abdomen a black mass was exposed, which proved to be the spleen. It was left untouched in this position, as it in no way interfered with the health of the patient. The cause of the dislocation appeared to have been a violent fall from a dog-cart.

Tumours arising in the central abdominal regions are often very puzzling: the presence of a well-defined area of resonant bowel between them and the pelvis, and the absence of any definite connection with the pelvis, though not sufficient for diagnosis, is sufficient to distinguish them, with rare exceptions, from ovarian tumours. It must be borne in mind, however, that in exceptional cases a tumour of pelvic origin may lose its pelvic attachment, and be fed by blood-vessels from omental and other adhesions; or may have so long a pedicle that it becomes entirely abdominal in position.

Diagnosis of ovarian and broad ligament tumours from other pelvic and abdominal tumours.—It has already been pointed out that the diagnosis of ovarian and broad ligament tumours is made by a process of exclusion of other forms, as well as by the recognition of the physical characters of the tumour under observation, characters which are not always so distinctive as to enable us to do more than arrive at an opinion of probability; and it not infrequently happens that the complete diagnosis is not made until the tumour has been exposed to sight and touch by an exploratory operation. It is obvious that under these circumstances it is not only necessary to know the varieties, the symptoms, and the physical characters of ovarian and broad ligament tumours, but that it is of no less importance to know also the varieties, the symptoms, and the physical characters of all tumours which may occupy the same region, or for other reasons be mistaken for them. It is not desirable within the limits of this article to enter upon this part of the subject, and I will only refer, for the last time, to the conditions which too frequently lead to easily preventable mistakes in diagnosis. Of these the most common are a normal pregnancy, a distended bladder, flatulent distention of the bowels, a fat abdominal wall, and, less frequently, simple ascites. Such mistakes are the result of ignorance of first principles, or of carelessness in examination; they are only to be prevented by knowledge, due care, and systematic examination.

Direct recognition of the physical characters of uncomplicated ovarian and broad ligament tumours.—The large majority of all such tumours are cystic. In the rare cases of solid ovarian tumours the diagnosis practically lies between them and uterine fibroids (either sessile or pedunculated) projecting from the peritoneal surface of the uterus; these are common enough. The direct diagnosis of the presence or absence of uterine fibroids by bimanual examination is not usually difficult. If hydroperitoneum be found complicating a solid tumour of pelvic origin the tumour may be assumed to be ovarian.

Cystic ovarian or broad ligament tumours, when uncomplicated by adhesions or impaction, are easily recognised by their well-defined spherical shape and obvious elasticity; but they have to be distinguished from cystic dilatation of the oviducts, and this is not by any means easy, unless the ovary on the same side can be defined by rectal examination. The close proximity of the two organs, and the great similarity in shape and other characters of the cysts formed in them, make this differential diagnosis often uncertain. The importance of it is, however, of the highest degree if extra-uterine gestation be suspected; for though the possibility of a primary ovarian pregnancy cannot be denied, experience shows that if the tumour can be proved to be ovarian, it is very improbable that it is the seat of a gestation sac. Cysts invading the broad ligaments, or originating in them, are more obviously lateral, and displace the uterus as they increase in size; they are less freely movable, and not rarely, as they grow, insinuate themselves beneath the peritoneum, beyond the limits of the broad ligaments in the pelvic and abdominal cavities. The essential points, then, in the diagnosis of a pelvic ovarian tumour are the discovery by bimanual examination of a spherical cystic tumour, or, much more rarely, of a solid one which although found to lie in close relation to the uterus is ascertained not to be uterine. It is, of course, in cases where the tumour and the uterus are closely pressed together, or are adherent, that mistakes are so easily made; but the absence of menorrhagia and of lengthening of the uterine cavity should put us on our guard; and the advantage of an examination under an anæsthetic, which completely relaxes the muscles, is very great. After consideration of the preceding details, it will be seen that Matthews Duncan's teaching fairly represents the difficulties of diagnosis

"I have said it is a nearly safe rude guess that you have an ovarian dropsy when you find a quickly-grown, cystic-feeling tumour in the belly of a woman, and this rude diagnosis is nearly safe because of the comparative frequency of ovarian dropsy as the cause of such tumours. . . . Every case demands careful investigation, for a good diagnosis is difficult, or, in other words, errors are frequent."

Diagnosis of torsion of the pedicle.—The symptoms of this complication vary according as the arrest of the circulation in the pedicle is sudden or gradual, complete or incomplete.

In the acute cases there is sudden and severe pain in the region of the pedicle, often accompanied by faintness, vomiting, and collapse. The abdomen is tender, and is distended by tympanitic bowel as well as by an increase in the size of the tumour. Such symptoms, occurring in a woman known to have a tumour in the pelvis or abdomen, are sufficient indication both for diagnosis and treatment. The tumour should be removed without delay: to wait for the subsidence of the symptoms of peritonitis is usually to wait until it is too late. Day by day, in such a case, the symptoms will become more grave; and careful observation of the tumour will often lead to the recognition of an unmistakable increase in size, to be distinguished from conditions simulating this, such as adhesions of coils of intestine and inflammatory exudation round it. Such enlargement, noticeable from one day to another, is the result usually of hæmorrhage into the cyst, or sometimes of the rapid formation of pus within it; the differential diagnosis between the two is not at all easy, but it is of no real importance, as the treatment in both cases is the same—immediate removal. The success which follows operative treatment in such cases marks one of the great advances in abdominal surgery in the last few years.

A temperature constantly below the normal is in favour of hæmorrhage; inflammation of the tumour, which usually results from acute strangulation, is attended by some degree of fever. In less acute cases the symptoms arise more gradually, and there is not the same imperative need for immediate removal; yet removal without undue delay is the best treatment. Adhesions, when recent, can be separated without difficulty, but when they become fibrous and tough, great difficulties may be incurred in the separation, and great injury may be done to important viscera (especially to the intestines), which leads to serious complications after the patient's recovery.

Adhesions of the omentum, even when extensive, are surgically of little importance. A curious condition of varicose vessels in the omentum, resembling a bundle of worms, is sometimes met with, lying immediately beneath the abdominal wall, on the surface of the tumour.

III. Inflammation of the Ovary

Inflammation of the ovaries usually forms one part of a widely extending inflammatory process involving the uterus, oviducts, pelvic peritoneum, and cellular tissue; the site of infection is most commonly the uterus or vagina, and spreading thence through the Fallopian tube, the organisms concerned eventually reach the ovary. If we attempt to regard oöphoritis as an independent malady, our views must of necessity be narrow and erroneous, not in pathology only, but also in diagnosis and treatment.

For convenience of description, inflammations of the ovary are divided into groups according as the surface covering, the ovarian stroma, or the Graafian follicles are chiefly involved. It must always be remembered that the differences are of degree rather than of kind, and that usually all parts of the ovary share to a greater or less extent in the lesion. We shall describe a peri-oöphoritis, an interstitial oöphoritis, and a parenchymatous oöphoritis; but the three varieties may be combined in one ovary.

In peri-oöphoritis adhesions bind the gland to adjacent peritoneum-clad structures. Such adhesions usually result from pelvic peritonitis; in rare cases they arise from an inflammation of the ovary, originally deeply seated, spreading towards the surface; they may be few, slender, and easily broken down, or so dense and firm that separation of the organ from the tube and uterus becomes an impossibility.

In recent cases the surface of the ovary is coated by flakes of lymph which readily become attached to any structures in contact with it; the movements and changes in position which the pelvic viscera constantly undergo lead to the formation of bands, eventually invaded by capillary loops and converted into fibrous tissue. As this newly-formed fibrous tissue contracts, the ovary and tube become closely united to one another, and frequently adherent to the back of the uterus. Microscopically we find in such cases that the germinal epithelium has disappeared, that the tunica albuginea is thickened and unduly fibrous, and that the more cortical part of the stroma is infiltrated with round inflammatory cells.

Acute oöphoritis results from invasion of the tissues of the ovary by pathogenic bacteria, or from the action of certain toxic substances. The bacteria most commonly concerned are the tubercle bacillus, the gonococcus of Neisser, and those organisms which cause infections of the puerperal uterus—streptococci, staphylococci, and the bacillus coli communis. Anaerobic saprophytes, the typhoid bacillus, and the pneumococcus have also been found occasionally. These organisms may gain entrance in various ways: through the blood-stream as in septicæmia, through the lymphatics, or through the Fallopian tube, either by spre of inflammation through its wall or by escape of pus from the abdomin ostium. Each newly-ruptured follicle is a recent wound, and may directly infected from structures in its neighbourhood, an inflam appendix, a suppurating wound, or a malignant growth. Not all ca of acute inflammation of the ovary are associated with the presence bacteria; it may be found in patients dead of phosphorus or metal poisoning, or in cases of infectious diseases as measles, scarlet fev cholera, epidemic parotitis, and influenza. According as the inflammatory process affects chiefly the follicles or the interstitial tissue, two varieties are described :—

(*a*) *Acute parenchymatous oöphoritis* is the type most often associated with the exanthemata and toxic conditions generally. The cells of the membrana granulosa undergo first cloudy swelling, later fatty degeneration; the ovum is destroyed, and the liquor folliculi becomes turbid or purulent. The stroma shares in the inflammation, but to a less marked degree, and hæmorrhages often occur into or around the follicles. To what extent this process may proceed without permanently destroying the functions of the ovary is unknown.

(*b*) *Acute interstitial oöphoritis* is met with in three degrees—a serous, a purulent, and a necrotic. In the serous form the ovary is enlarged and elastic to the touch; on section numerous injected vessels stand out clearly from an intensely œdematous stroma. Microscopically small-cell infiltration of the connective tissue, chiefly along the lines of the vessels, is seen; later the follicles become involved, hæmorrhages occur into them, and the surface is coated by a fibrinous exudate.

The suppurative variety presents the same general features, and is either a further stage of the same process, or depends upon a more virulent infection. Streaks of yellow pus are found in the stroma, and multiple abscesses in the follicles; by the coalescence of these the whole ovary is sometimes converted into a bag of pus. This is the variety most common in severe puerperal infections.

In the rare necrotic form the ovary is enlarged and sloughing, and in its interior are areas of hæmorrhage and collections of pus. According to Beyea these cases most commonly depend upon the presence of anaerobic saprophytic organisms.

Acute gonorrhœal oöphoritis results from infection by direct continuity from the Fallopian tube. In the early stages the ovary is enlarged, rounded, and soft; its surface is usually free from adhesions and other evidences of inflammation. On section the follicles and corpora lutea are filled with turbid fluid or with pus, the lining wall of the follicle forming the abscess boundary. In other cases the inflammation is chiefly interstitial, with dilated vessels, œdema, and small-cell exudation into the stroma, and in very acute cases with purulent infiltration. It is extremely difficult to demonstrate the presence of gonococci in the pus.

Chronic Oöphoritis.—Under this name widely different conditions have been described, some undoubtedly of inflammatory origin, others possibly, but by no means certainly, the result of a past inflammation. We sometimes find ovaries which are tender, painful, and bound by adhesions to the Fallopian tube and adjacent viscera; these on microscopic examination show undoubted evidence of inflammatory changes. There are, on the other hand, two forms of disease, known respectively as sclero-cystic disease and cirrhosis, in which the ovaries are freely movable and without adhesions, but in which certain pathological changes have occurred. It may be that these conditions also are remote results of a previous inflammation, but in the absence of fixation and adhesions such an origin is difficult to prove.

A chronically inflamed ovary may be enlarged to three or four times its normal bulk, or may be shrunken and atrophied; the follicles may be cystic and dilated, or they may have entirely disappeared; the surface may be covered by adhesions which are firm and fibrous, or a few slender flakes and bands may be the only visible external signs. Two main types are recognised, a chronic interstitial oöphoritis and a chronic universal oöphoritis.

In the *chronic interstitial* variety the albuginea is thickened and converted into dense connective tissue; the stroma is closely set, unusually cellular, and shows areas of small-cell infiltration. The follicles are few and shrunken; if ovulation still occur the corpora lutea are small and undergo extensive hyaline change. Hyaline degeneration is also seen in the stroma tissues and vessel walls. The surface epithelium, where free from adhesions, may be replaced by columnar ciliated cells which have spread to the surface of the ovary from the tubal fimbria.

Chronic universal oöphoritis possesses many features in common with sclero-cystic disease; but whereas in the former fixation by adhesions and other evidence of inflammation are present, in the latter these are wanting.

The ovary is enlarged from cystic degeneration of the follicles; the cysts, however, are not confined to the periphery, but scattered throughout the stroma. The follicles are invaded by leucocytes, and their epithelium degenerates and disappears, whilst the walls become thickened from proliferation of the connective tissue. The interstitial tissues are inflamed, and undergo hyaline degeneration.

Sclero-cystic disease of the ovary is a term applied to a condition in which extensive cystic degeneration of the follicles is accompanied by an increase in density and alteration in structure of the tissues of the stroma. The pathology is as yet imperfectly understood; indeed Nagel and others maintain that the change is a physiological one. Very little help can be obtained from the clinical side of the picture, the almost constant association with other pelvic lesions rendering it impossible to ascribe any definite train of symptoms to this condition.

The cysts vary in size, some are as large as a pea, others as large as a walnut; from one to twenty may be found in an ovary; they are not confined to the periphery, but are scattered throughout the whole gland. On microscopic examination there is found a scarcity of normal follicles, and a marked hyaline degeneration of the vessel walls and stroma. In cysts larger than a pea the wall is formed solely of fibrous tissue; neither ovum nor membrana granulosa can be discovered. The stroma is dense and fibrous, but changes clearly inflammatory are not seen, and, as previously stated, surface adhesions are absent. The close resemblance between these ovaries and ovaries which are chronically inflamed renders it highly probable that, in spite of the absence of surface adhesions, the condition is the result of a previous inflammatory affection. Such ovaries do not necessarily give rise to symptoms nor always need removal.

Cirrhosis of the ovary.—As age advances shrinkage of the ovary occurs, the follicles disappear, the stroma becomes more fibrous, and the blood-vessels are few and degenerate. Sometimes at an age when a woman should be in the full vigour of child-bearing life a similar condition is found; under these circumstances the changes are believed to be the result of disease, and to them is applied the term "cirrhosis."

There are in St. Bartholomew's Hospital Museum a pair of such ovaries placed there by Dr. Matthews Duncan; they were removed from the body of a woman of 33, who had ceased to menstruate two years before her death; they consist of a thickened albuginea enclosing small masses of dense fibrous tissue, and represent an extreme grade of the process we are now describing.

In cirrhosis the ovaries are characterised by a thickening and hardening of the albuginea; the stroma is fibrous and firm, the follicles are few, or, as is often the case, entirely absent; no corpora lutea are present; the vessels are thick-walled and surrounded by a zone of fibrous tissue, and the surface epithelium is flattened. This condition differs from cirrhosis of other organs such as the liver or kidney in that the interstitial tissue is not infiltrated with small round inflammatory cells, and it would perhaps be better if we contented ourselves with the term "fibroid ovary," a name which implies no theory of origin. It is uncertain if this condition is often a cause of pain.

Oöphoritis serosa (œdema of the ovary) was originally described by Olshausen, but must now be regarded as the result of œdema and circulatory changes rather than as a true inflammation. It occurs most frequently in association with fibroids and other pelvic tumours which have altered the relations and interfered with the circulation in the ovary; it is found also in cases of chronic ill-health due to anæmia, cardiac, hepatic, or renal disease and alcoholism. The ovaries are swollen, smooth, and almost translucent; their surface folds and cicatrices are often obliterated. When incised serum escapes freely.

Abscess of the Ovary.—In most cases of ovarian abscess the infection is conveyed through the Fallopian tube, and the condition is secondary to pyosalpinx. Occasionally suppuration in the ovary occurs in the course of acute parametritis or pyæmia, or may be due to infection by the tubercle bacillus or the ray fungus of actinomycosis. A very rare cause is the presence of a foreign body; Haviland removed a suppurating ovary from a woman aged twenty-one, and found in the abscess cavity a piece of sewing needle two centimetres long. Suppuration may also occur in an ovarian cyst, particularly in cases in which adhesions to some part of the intestinal canal have been contracted.

Three varieties of ovarian abscess may be recognised—(1) abscess of the corpus luteum; (2) abscess of the follicles; (3) interstitial abscess.

(1) *Abscess of the corpus luteum.*—The rupture of every follicle leaves a recent wound on the surface of the ovary. In most cases of

pyosalpinx no ovarian infection occurs, for the organisms are securely shut off by the thickened wall of the tube; in some cases, however, direct infection occurs, particularly when absorption of tissue has led to a communication between the tube lumen and the ruptured follicle. It is in this way that tubovarian abscesses are formed. An abscess of the corpus luteum seldom attains a size larger than that of a walnut. The cavity is usually lined by velvety granulation tissue, which sometimes projects from the inner surface of the yellow lutein layer in the form of small papillary processes; the surrounding connective tissue is very vascular, and everywhere infiltrated with small round cells, which may ultimately become converted into dense fibrous tissue. Such abscesses may be very chronic, and in long-standing cases the pus may be absolutely sterile.

(2) *Follicle abscesses* are most often seen in cases of acute parenchymatous oöphoritis, and have already been described.

(3) *Interstitial abscess* arises by the gradual fusion of numerous small foci of suppuration scattered through the stroma. At first the abscess possesses only a ragged, ill-defined wall, but later a firm limiting zone of fibrous tissue is formed. As the abscess increases in size all trace of ovarian stroma may be lost, until finally the cavity is bounded only by the thickened albuginea, a structure which is remarkably resistant.

Such an abscess may remain quiescent, and give rise to no symptoms for an almost indefinite period; then, as the result of injury during labour, may rupture and cause an acute peritonitis.

Tubercle.—Tubercle of the ovary is probably always secondary to tubercle in some other part of the body. Schöttlander has succeeded in experimentally producing primary tuberculosis of the ovary in animals, but whether a similar condition is ever found in the human subject is still doubtful.

Between the years 1880 and 1902, 798 autopsies upon women dead of tuberculosis were performed at the Brompton Hospital; the genital tract was affected in 62 (7·7 per cent). Of these 62 cases the ovaries were affected in 8 (12·8 per cent). These figures agree very closely with other published collections of statistics.

There are two routes by which the tubercle bacilli may reach the ovary—(1) through the blood or lymph streams; (2) through direct contact of the ovary with some infected structure in its neighbourhood. That infection through the former route occurs sometimes is proved by the fact that we occasionally find in patients who have died of phthisis isolated masses of tubercle in the ovary, whilst the structures which surround it are free from disease. Infection by direct contact is, however, much commoner, and tubercle of the ovary is usually associated with the presence of caseous or miliary tubercle of the Fallopian tube, intestines, or peritoneum. At each period of ovulation a recent wound, the ruptured follicle, is left in direct contact with the abdominal cavity; through this, in cases of tuberculous peritonitis or salpingitis, the bacilli gain entrance, and tubercle of the corpus luteum is a well-known phenomenon.

Tubercle of the ovary occurs at all ages—in childhood, in mature sexual life, and in old age; it is, however, much less common than tubercle of the Fallopian tube.

The affection is usually bilateral; it is met with in three forms—(1) as miliary tubercles, (2) as caseous masses, (3) as tuberculous abscess. The first is the commonest variety; the last two occur sometimes in conjunction with one another.

(1) Miliary tubercle is most often seen in the form of a peri-oöphoritis; the peritoneum in the neighbourhood and the Fallopian tube are likewise studded with small glistening nodules; the ovary is often of normal size, and exhibits adhesions to the tube and other structures. Microscopically the nodules show the usual arrangement of rounded, epithelioid, and giant cells, but as a rule it is difficult to demonstrate the presence of the bacillus. Tubercle of the unruptured follicles has not yet been described, but it is not rare to find infection of the corpus luteum, such infection often occurring directly through the wall of the Fallopian tube. In these cases an extensive formation of tuberculous nodules is seen within the lutein layer; the tubercles are often extremely rich in giant cells, which exhibit fine branching processes. Miliary tuberculosis of the stroma is not so common, but probably in all cases precedes the development of the second and third varieties. The deposits occur in the medulla or cortex according to the mode of infection; if by the lymphatic or blood-stream in the medulla, if by direct contact in the cortex. Isolated tubercles and giant cells are scattered through the stroma, and it is by fusion of numbers of these small nodules that the caseous masses are formed.

(2) To this variety the term "chronic fibro-caseous tuberculosis" is applied. The ovary may be enlarged to the size of a goose's egg, and on section many areas of crumbling caseous material are seen. These are separated from one another, and encapsuled, by dense fibrous tissue.

(3) In tuberculous abscess the organ may be enlarged to the size of a child's head, and may be converted into a mere sac of pus. Usually the abscess does not exceed the size of a pigeon's egg, and is combined with caseous masses in other parts of the gland. In some cases of abscess there is a secondary infection, and the pus contains the common pyogenic organisms. In a patient in whom there exist simultaneously an ovarian cyst and some form of abdominal tuberculosis, infection of the cyst wall may occur, and its surface become studded with miliary tubercles; later the contents of the cyst may become converted into a purulent caseous mass.

The symptoms of oöphoritis are by no means easily distinguishable from those due to the inflammation of other pelvic viscera so commonly present at the same time. In cases of acute septic poisoning, with the most active destruction of the ovary, we know of no symptoms significant of the ovarian lesion; the disease is septicæmia, and we do not attempt to analyse the symptoms or to recognise the manifestations of the disease in an organ so unimportant to life.

It is in the less severe inflammations that we are able to recognise symptoms with distinguishing characters, and in some of them by physical examination to diagnose the less grave forms of oöphoritis. All forms of oöphoritis are so intimately associated with inflammation of the oviducts and the surrounding peritoneum that in the present state of our knowledge we can only describe the general symptoms of these associated lesions.

Pain is the one constant symptom of all varieties of pelvic inflammation, and the site to which it is referred by the patient bears no constant relation to the organ affected. It may be distributed over a wide area; in some cases it is felt chiefly in the region of the umbilicus, in other cases in the thighs, and as low as the knees; the iliac regions, the loins, and the sacral region may all be involved. There is nothing in the character of the pain itself which enables us to recognise that its cause lies in the ovary rather than in other pelvic viscera. Those who have read Dr. Head's valuable work on localisation of pain due to visceral disease may be disappointed that greater practical results have not as yet followed in this and in other regions of the body from his investigations, which are of the highest value, and which must in time lead to very important results. The reasons in this case are obvious; the four areas localised by him, namely, 10th, 11th, and 12th dorsal, and 1st lumbar, are common in different degrees to the ovary, tube, and body of the uterus; and further investigation is necessary to enable us to distinguish disease confined to any one of these organs; indeed, the common diseases causing pain most frequently affect all these parts. The pain is aggravated, as are all pains due to inflammation, by any increase of pressure on or within the ovary. The most important cause of increased tension within the gland is the premenstrual vascular congestion, and during the days immediately preceding the menstrual flow the pain is usually most intense. It is easily distinguished from the pain of true dysmenorrhœa as it is the aggravation of a pain which is continuous, while true dysmenorrhœa is a purely menstrual pain. There are, apparently, exceptions to the rule of increase of pain associated with the menstrual periods, for we meet sometimes with patients who say that the only time they are free from pain is during the menstrual flow.

The pain that persists after coitus may also be due in some cases to congestive tension. The most frequent source of pain is the increase of the general intra-abdominal pressure which follows straining efforts even of a comparatively slight degree. Such pain is relieved gradually by the horizontal position, and for its relief some patients spontaneously lie on the back, others on the chest or side. Pain is also caused by direct pressure on the organs through the abdominal walls, the vagina, or rectum; as for instance during a medical examination, on coitus, or the passage of large fæcal masses.

Of the other great symptoms of pelvic disorder, hæmorrhages, menstrual or intermenstrual, amenorrhœa, and leucorrhœa, none is known to be characteristic of oöphoritis. The presence or absence of any one of them probably depends largely on the extent of the inflammation of the uterus itself, and on the general state of the patient's health.

Reference must not be omitted to the wide distribution of neurotic symptoms in women suffering from various pelvic ailments, including those of the ovary. To discuss this subject adequately would require a space beyond that allotted to us, but it may safely be said (*a*) that the local pelvic lesion is most frequently a minor one; (*b*) that different authors attribute these symptoms to lesions of various organs, the commonest lesions being oöphoritis, displacements of the uterus, and fissures of the cervix; (*c*) that the same symptoms are not generally met with in women of robust minds who suffer from these very common local lesions; (*d*) that the nerve symptoms have a great tendency to persist after the cure of the local lesion; (*e*) that the greatest benefit is obtained by attention to the principles of general treatment, that is, by a treatment tending to restore and increase the vigour of the mind in a more vigorous body—a restoration, however, by no means always practicable. Such cases form a great source of gain to all kinds of quack practitioners; and whilst the treatment of some of these in a rational and honourable manner is rewarded by immediate and permanent success, many are a continual source of disappointment to all whose misfortune it is to be their relatives or medical advisers.

Diagnosis of oöphoritis can be made only with certainty when the finger in the rectum, or less frequently in the vagina, recognises a tender body of the shape of the healthy organ, but somewhat larger, lying to one side of or behind the uterus and broad ligament.

Fixation by adhesions interferes with this ready recognition, and unless special means be adopted to insure that the circumstances under which the examination is made are the most favourable possible, there will constantly be doubt as to how much of the swelling is ovary, how much tube, and how much adhesions and surrounding effusion.

The most favourable conditions for examination of a difficult case are an absence of obesity, the influence of an anæsthetic, the lithotomy position, emptiness of the rectum and bladder, and the drawing down of the uterus by a suitable instrument. Even with these advantages it is not surprising that we are foiled at times in our search for precise knowledge, for in some cases, even after removal of the organs, there may be doubt how much is ovary and how much tube. And when we succeed, our success is more often a source of satisfaction to our pride than a benefit to our patient, whose treatment, whether by operation or by a prolonged course of medical means, is not materially affected by the seat of the disease, whether it be in ovary or tube; the essential thing is the diagnosis of the presence of inflammation, its degree, its duration, and its effects.

Treatment.—The general principles which govern the treatment of inflamed ovaries are common to all cases of pelvic inflammation; but the most valuable, namely, rest in bed, may easily be carried too far, especially in the slighter cases. Great care is needed in watching the patient to observe the effects of this treatment on the general health, as well as on the local condition, in order that the physician may be enabled to put a proper limit to its application. The same close attention must be paid to the effects of drugs administered for the relief of pain. Acute pain must be relieved; to this end hot applications to the hypogastric region are effectual, and hot vaginal injections also, though to a less extent; more direct relief will, in some cases, have to be afforded by such drugs as opium. In the protracted cases the application of heat will soon lose its good effects; anodynes will not only likewise fail, but will become a positive source of danger to the patient. If the suffering is genuine and severe, and not out of all proportion to the ascertained lesions, removal of the inflamed organ by operation will have to be considered, and probably adopted. But in cases where the lesions are small and the nerve symptoms great, the treatment should be entirely different. We should endeavour in every way to improve the general health, and should neglect the local disorder as far as possible.

Actinomycosis of the ovary is a rare disease, and has been described only as a secondary infection. Dr. Berry Hart has recently recorded a case of abdominal actinomycosis in which the stroma of the ovary was softened and infiltrated with small punctiform abscesses. The condition is generally regarded as tuberculosis until microscopic demonstration of the presence of the ray fungus proves the true nature of the lesion.

Hydatids of the Ovary.—Cysts due to the development of the ova of tænia echinococcus may possibly originate in the ovary, but in the vast majority of cases the gland is only secondarily involved. A case published by Péan in 1895 is widely quoted as an instance of primary infection; the description, however, is brief and unsatisfactory—"Cyst wall white and moderately thick. On puncture eight litres of limpid fluid mixed with hydatids. Incision of the cyst enabled us to withdraw a considerable quantity of daughter cysts, and to determine that the cyst had originated in the ovary, and had become prolonged into the broad ligament." Two cases of primary hydatid disease of the Fallopian tube are on record (Doléris and Eden, *vide* p. 497), and eight cases of primary uterine hydatids. In most cases of pelvic hydatid disease the cellular tissue is the site of deposition.

IV. HÆMORRHAGE INTO THE OVARY

The rupture of the Graafian follicle which occurs at the time of ovulation is accompanied by hæmorrhage, leading to the formation of a blood-clot in the follicle cavity. A recent corpus luteum is commonly as large as a small cherry, but under conditions, such as pregnancy, in which the blood-supply of the pelvic organs is increased, the size attained is often considerably greater.

Pathological hæmorrhages into the interior of the ovary are divided into two groups:—1. Hæmorrhage into pre-existing cavities, in which the blood remains encapsuled by a cyst wall. 2. Hæmorrhage into the ovarian stroma (ovarian hæmatoma).

In the former group we recognise three varieties :—

(*a*) The bleeding may occur into a single follicle cavity, which may thus become converted into a blood-cyst the size of a walnut. These single follicular blood-cysts are most frequently associated with inflammation of the ovary.

(*b*) The bleeding may occur into the cavities of several follicles simultaneously, and a number of small follicular hæmorrhages are scattered through the substance of the ovary. In these cases isolated extravasations of blood and minute punctiform hæmorrhages occur in the stroma also. The condition is commonly associated with grave septic infection or acute toxic poisoning.

(*c*) Hæmorrhage may occur into the cavity of an ovarian cyst as the result of torsion of its pedicle. This accident has already been discussed (p. 450).

Hæmatoma of the ovary differs from the varieties just described in that the hæmorrhage occurs not into an encapsuled cavity, but into the ovarian stroma. The hæmorrhage may be sufficiently profuse to form a tumour the size of an orange; on section such a tumour consists of a central blood-clot surrounded by a capsule of stretched and expanded ovarian tissue.

The proof which has been furnished by certain recent cases of the existence of primary ovarian gestation, throws an entirely new light upon some cases of ovarian hæmatoma. Scattered through the literature are many records of cases of this nature which terminated in spontaneous rupture of the organ. Reading the clinical histories in the light we now possess, it becomes almost certain that many of them were instances of ovarian gestation; this condition is described in another section of this system and need not be further considered here (p. 601).

All cases of hæmatoma of the ovary, however, are not cases of ovarian gestation; we have recently investigated two specimens in the museum of St. Bartholomew's Hospital, but could find no chorionic villi or other fœtal structures. Of the pathology of these cases we are in ignorance; it is generally believed that secondary rupture of a blood-containing follicle into the stroma is the determining factor, but of the causes which lead to such rupture we know nothing.

The ovary, enlarged and heavy, falls into Douglas's pouch. In course of time the fluid portion of the blood is absorbed, and a clot of almost colourless fibrin occupies the central cavity. The symptoms are indefinite; uterine hæmorrhage and pelvic pain have been present in most of the recorded cases.

V. OVARIAN CONCRETIONS

Ovarian concretions are of two varieties; some consist of calcium salts, others of altered blood-proteids and pigments.

Calcareous concretions form occasionally in those masses of hyalin which mark one stage in the degeneration of the corpus luteum, and were described by Petenko under the name of "corpora fibrosa." In other cases calcareous salts are deposited in more recent corpora lutea, and form hard, mulberry-like calculi, which possess the bright yellow colour of lutein.

Concretions of the second variety are rare. Mackenzie has recorded a case in which the ovaries contained a number of hard, black bodies lying in smooth-walled cavities. Their chemical composition was determined by Copeman, who found that they consisted of coagulated proteids derived from blood-clot, and coloured by a pigment which gave the distinctive spectrum of acid hæmatin.

VI. Malpositions and Displacements of the Ovary

Non-descent of the Ovary.—In the early stages of its development the ovary occupies a position in close proximity to the kidney; in most vertebrates this position is maintained throughout life, but in the human subject descent into the pelvis takes place. Non-descent of the ovary is a rare anomaly, and but few cases have been recorded. The condition is seen most frequently in young infants or still-born children, and in some instances the cæcum also persists in its original position in the right hypochondrium. Bland-Sutton has recorded a case of great clinical interest. The patient, a girl of 19, complained of a tender swelling situated in the left iliac fossa above the level of the pelvic brim. On exploration the swelling was found to be an elongated ovary lying with its long axis parallel to the ureter.

Prolapse of the Ovary.—The anatomical position and relations of the ovary are described in the section on anatomy. The normal position is maintained partly by folds of peritoneum and partly by special ligaments; none of these supporting structures possess great strength or stability, and under the influence of certain disturbing conditions the ovary sinks in the pelvic cavity and becomes prolapsed.

Various varieties and degrees of prolapse have been described; it is sufficient to remember that the ovary may be situated in front of or behind the uterus, or even in the cup-shaped depression which occupies the situation of the fundus in cases of inversion. The ovary is found in front of the uterus when fixed there by peritoneal adhesions, and this displacement is to be regarded as a result of pelvic inflammation. In inversion of the uterus the position of the ovary is a detail upon which it is unnecessary to dwell.

Of greater importance are the cases in which the displaced organ lies posterior to the uterus. A distinction is sometimes made between those in which the ovary lies lower than the normal, but still above the utero-sacral ligaments (retrolateral displacement), and those in which it lies below these structures, and consequently occupies Douglas's pouch (retro-uterine displacement). The former condition is probably simply an earlier stage of the latter.

Of the predisposing causes of prolapse the commonest and most important is pregnancy. The great displacement and stretching which the broad ligaments, ovarian ligaments, and other structures undergo may, if often repeated, lead to a permanent relaxation and weakening of ovarian supports. If the organ becomes enlarged, whether as the result of inflammation, of new growth, or of hæmorrhage, its weight will be increased and it will tend to sink. The contraction of adhesions in cases of peritonitis may drag an ovary down and fix it to the pelvic floor. Finally, if the uterus be retroflexed, the broad ligaments and ovaries are affected by the change of position, and prolapse may result. In the majority of cases it is in the presence of one or other of these conditions that the explanation of the prolapse is to be found; more rarely, direct increase of intra-abdominal pressure, as from a tumour or diminished pelvic obliquity, may be the exciting cause.

Symptoms.—Prolapse of an ovary is a displacement of a sensitive organ from a position of free mobility and of security from violent pressure (lying as it does between the elastic bowels and broad ligaments) to a position in which its mobility is very much restricted (especially if both ovaries are prolapsed into Douglas's pouch), and where it is very liable to be squeezed by the surrounding parts as the result of the variations of general intra-abdominal pressure, which occur with muscular exertion and with the distention of bowels and bladder. These changes cause more or less constant aching, and the pain is increased as the menstrual congestion recurs. Furthermore, the organs are liable to special pressure during coitus, and during the passage of large or hard fæcal masses through the rectum—both of which disturbances cause sudden and severe paroxysms of pain.

A prolapsed ovary is usually swollen, and is more sensitive to pressure than when in its natural position; but it is not easy to say whether these changes are due to the prolapse or not. The conditions under which prolapse occurs are such as would usually cause swelling, and, consequently, increased sensitiveness of the organs.

Diagnosis.—This is comparatively easy in the case of simple prolapsed, non-adherent ovaries; a movable, sensitive, often very tender swelling of the shape of the healthy ovary, but usually of a somewhat larger size, is found lying behind the uterus and (if completely prolapsed) behind the upper inch of the vagina, in front of the rectum.

When there are adhesions it is often not at all easy to distinguish the ovary from the prolapsed distended extremity of the oviduct.

The treatment of prolapsed ovaries is always a very troublesome matter; in itself it is a minor disease, but unless relieved it may be a source of great and continual suffering lasting until the climacteric is well passed.

If the prolapsed ovary be movable and not greatly enlarged, and particularly if the uterus be retroverted, retroflexed, or prolapsed, relief can be given by carefully replacing the uterus and supporting it, with broad ligaments, and, to a certain extent, the ovaries, by a suitable pessary of the "Hodge" type; or, if that cannot be borne, by an india-rubber ring. The patient in such cases should never be kept lying on her back. So long as rest is necessary she should lie in such a position that the tendency to prolapse of the ovaries is the least possible, and this will be when she lies on the chest, or semi-prone. This method, combined with attention to the general health, is usually successful.

When the prolapsed ovary is adherent, and proper treatment fails within a reasonable time to get rid of the adhesions and allow the ovary to return to its natural position, great relief can be given by an operation through the vagina or abdominal wall, having as its object the release of the fixed ovary from its prolapsed position, saving it, if possible, and, if necessary, fixing it higher up where the pressure effects are far less likely to be injurious.

We know of no drugs which have any direct effect on the structure or functions of the ovary; its minor diseases are best treated by general means, such as fresh air, exercise, proper food, daily evacuation of the bowels, and tonics, with avoidance of injurious pursuits and occupations. Ovarian pain, in the absence of severe lesions, will be most readily and permanently relieved by such measures.

Hernia of the Ovary.—At the time of birth the inguinal canal is occupied by a pouch of peritoneum, the canal of Nuck. In spite of the direct communication between this canal and the peritoneal cavity, congenital hernia of the ovary is a rare condition. We occasionally find in the inguinal canal of young children small movable bodies which yield no fluid on puncture and are believed to be ovaries. In some of these cases operations or post-mortem dissections have been performed and the diagnosis found to be correct. It must be remembered that positive proof rests only on microscopic examination, and some of these bodies which from their naked-eye appearance and the characters of the external genitals were regarded as ovaries have, on microscopic examination, proved to be testes.

Acquired hernia of the ovary may be found at any age. The inguinal and femoral varieties are the commonest, but the ovary has been found within the sacs of ventral, umbilical, gluteal, and obturator herniæ.

The gland is commonly accompanied by the Fallopian tube, rarely by the uterus or by one horn of a bicornute uterus (*vide* p. 477); sometimes it is drawn into the sac by adhesions uniting it to omentum or a knuckle of bowel. The ovary may become cystic; a case of gluteal cyst is recorded by Boinet, which was found to be of ovarian origin. As the fundus of the uterus rises in the abdomen during pregnancy, the ovary may be completely withdrawn from its hernial sac, only to again descend during the puerperium.

The displacement is no absolute bar to conception, and a corpus luteum of pregnancy has been described in a displaced ovary. The ovary forms a firm, almond-shaped movable swelling in the groin or labium majus. During menstruation it often enlarges and becomes tender and painful; an increase in size is also sometimes observed during pregnancy. On firm pressure a sickening sensation may be experienced, and sometimes it gives rise to persistent pain of a degree so severe as to render the patient a chronic invalid.

Symptoms of an urgent character may arise, vomiting, abdominal distention, rise of temperature, and increase of pulse-frequency. In a case of this kind admitted into St. Bartholomew's Hospital and diagnosed as a strangulated hernia, these symptoms were found to depend upon torsion of the pedicle with extravasation of blood into the tube, broad ligament, and ovary.

Diagnosis is difficult and uncertain; when the hernia is irreducible and gives rise to symptoms, there can be no doubt as to the propriety of surgical interference.

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W. S. A. G.
H. W.

DISEASES OF THE FALLOPIAN TUBES

Injuries of the Fallopian Tubes.—The Fallopian tubes are tough, and no structures in the body are better protected by their position and relations. They accommodate themselves, as is well known, to the normal changes of the uterus in pregnancy. A wound of a Fallopian tube from a knife or similar weapon would involve, in all probability, more serious injuries to neighbouring vessels and viscera than to the tube itself. The experience of countless ovariotomies and allied operations teaches us that the healthy tube bears very well the necessary injury inflicted by the ligature of the pedicle. With the inflamed tube it is quite otherwise, as will be explained later. The amputation of both tubes does not necessarily doom the patient to sterility; one stump, however carefully ligatured, may somehow get free and become perfectly competent to transmit an ovum from a fragment of ovary to the uterine cavity. Hence we can understand the occasional occurrence of pregnancy after the removal of both ovaries and tubes (Meredith, 41; author, 17*k*, and others), and the occasional failure of excision of a segment of both tubes, in the course of a Cæsarean section, to ensure sterility.[1]

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[1] A few cases of Fallopian tube *fistulæ*, vaginal as well as abdominal, have been recorded after either operation or puerperal pelvic suppuration (Hæckel).

Atrophy and Hypertrophy of the Tube.—In emaciation and at the menopause the tube undergoes more or less atrophy. Local atrophy, even to complete division, may be caused by the pressure of tough perimetritic bands, but is usually the result of axial rotation of an ovarian tumour. I have twice found a tube stretched to a great length and reduced to a thin solid cord by adhesion to omentum which had dragged it up above the pelvic brim. A uterine fibroid may cause atrophy of a tube by pressing it against the pelvic wall.

Hypertrophy occurs in pregnancy and often in association with the development of uterine fibroids. When connected with an ovarian cyst or dermoid, the tube tends to increase in size; when the tumour of the ovary is solid this change is less frequent. The operator must remember that the normal tube in a healthy young woman is a stout, deep red, tortuous, worm-like structure with thick budding fimbriæ, very unlike a tube removed from a dissecting-room subject and preserved in a bottle of diluted alcohol.[1]

Hernia of the Fallopian Tube.—In a few instances of inguinal hernia the tube formed the sole contents of the sac; in one case the tube was found strangulated by the neck of an otherwise empty femoral sac. On the other hand, when the ovary occupies a hernial sac, the tube does not always accompany it (*vide* p. 474). In "salpingocele" the tube has been found invested by the peritoneum of the sac itself instead of the mesosalpinx. This condition is probably associated with congenital malformation elsewhere. The operator must remember that when a tube-like body is found in a hernial sac the patient may nevertheless prove to be a male hermaphrodite, even when an ill-developed uterine cornu is detected. Hence, as in the case of ovarian hernia, the vulva and vagina must be carefully explored whilst the patient is still under the anæsthetic.

INFLAMMATION OF THE TUBE OR SALPINGITIS

This condition is intimately associated with inflammatory affections of the uterus, ovaries, and, in rarer but distinct instances, of the vermiform appendix. It is doubtful whether there be such a disease as mere salpingitis. Infection usually reaches the tube through the vagina and uterus; hence the close relation between puerperal troubles and salpingitis, and the equally close relation between gonorrhœa and that disease. As salpingitis is seen in virgins, there must be other sources of infection, and amongst them tubercle stands out very definitely, as it has been detected in infants (Chaffey, Silcock), and is by no means rare in young girls. It seems reasonable to believe that in a sickly subject chronic leucorrhœa may account for some cases of tubal infection in virgins. Lastly, a suppurating vermiform appendix may become adherent to the tube, even in some instances to the left tube, just as a suppurating tube may infect the appendix.

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[1] I need not dwell at length on the question of an abnormally patulous condition of the tubal canal, allowing the sound or injections to pass into the peritoneal cavity; for it is not certain how far such a condition may be normal, or a peculiarity, not exactly pathological, in certain subjects. Proof that the sound has entered the tube, and not perforated the uterus, is very difficult (Ahlfeld, *Zentralbl. f. Gynäk.* 1902, p. 1072), so that *catheterisation of the tubes* as a surgical procedure is not to be thought of. The question of injections passing through the tube remains unsettled (see Thorn, "Die Durchgängigkeit der Tuben für in den Uterus injizierte Flüssigkeiten," *Zentralbl. f. Gynäk.* 1904, p. 1128).

Varieties of Salpingitis.—The nomenclature of this disease has grown complicated as its varieties have been classified on different principles; sometimes according to germs which infect the tubal mucosa, sometimes according to various histological changes which are not limited to one form, and sometimes on the principles of general pathology, making allowance for special peculiarities in the nature and functions of the tube. Amongst others, Orthmann (45*c*) especially has done much to classify this disease in a simple, rational manner.

It is best to subdivide inflammation of the tube, first, into *catarrhal* and *suppurative* salpingitis, independent of obstruction of the ostium and the uterine end of the canal. Obstruction may result in three conditions: *hydrosalpinx*, *pyosalpinx*, and *hæmatosalpinx*, but it will be shown that none of the three is a necessary sequel of salpingitis, a point of great clinical and surgical importance.

Tubercle, as well as actinomycosis, leprosy, and syphilis, sets up inflammatory changes in the tube classified by Orthmann under the head of *infective granuloma*. Tuberculosis of the tube, a disease of high importance, will be considered separately.

In *catarrhal salpingitis* there is at first clear discharge from the ostium, which, if not septic, does not cause local peritonitis; undoubtedly it may run into the uterine cavity; indeed, in the purulent variety pus may be discharged into the uterus, but the swelling of the mucosa tends to obstruct the canal, naturally narrow, in its course through the uterine wall. The catarrhal discharge soon becomes thick "muco-pus," and is often sanious. The tube, by infiltration into its tissues, increases in length, thickness, and firmness; and, being confined within the folds of the mesosalpinx,[1] becomes tortuous—a very characteristic change. Great stress is laid by systematic writers on the irregular density of the tube in chronic salpingitis.

As the infiltration into the muscular coat is not uniform, the tube in chronic salpingitis feels knotty; but the nodules represent one of two different histological changes presently to be described. A true *sclerosis* of the tube is the usual termination of chronic non-obstructive salpingitis; earthy salts become deposited in the thickened tube, which is thus rendered very brittle. The ligature applied during an operation may, when tightened, cut through such a tube; and in detaching the tube from dense adhesions it will tear or even snap. The mucus in an old inflamed tube becomes inspissated, holding earthy salts in suspension; this in extreme cases forms one variety of *tubal calculus*. Dr. T. S. Cullen describes and figures an S-shaped calculus nearly an inch long which he found in an inflamed and distended tube (*Johns Hopkins Hospital Reports*, vol. iv. case 21, pl. xvii. fig. 5); but, as will be presently explained, there are tubal calculi of a different origin. Catarrhal salpingitis may cause closure of the tube, sometimes very early, sometimes not till after weeks or months of inflammation more or less recurrent; whilst the ostium often remains patent when the tube has become sclerosed and tortuous.

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[1] The mesosalpinx, as well as the tube, undergoes hypertrophy when a cystic ovarian tumour develops, hence the tube does not become tortuous. For some reason not yet explained, in most cases of solid ovarian tumour neither tube nor mesosalpinx becomes hypertrophied.

In catarrhal salpingitis the epithelium is often shed very irregularly, but not destroyed; yet it may remain almost intact, even when the inflammation is chronic. The plicæ become injected, swollen, and thickened (compare Fig. 123 with Fig. 124) by small-celled infiltration, the vessels are engorged, and the lymph-spaces often greatly dilated.[1]

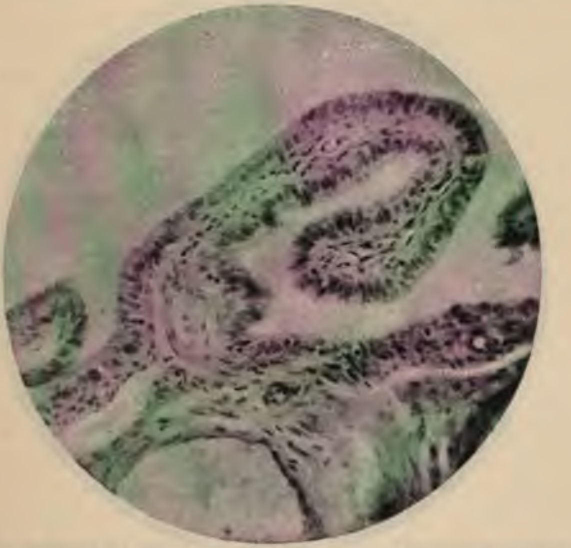

FIG. 123.—Plica of a normal tube from a young subject, as seen under a ¼-inch objective. It is slender and well formed; its surface is invested with columnar ciliated epithelium. The corresponding ovary was removed, as it showed signs of incipient cystic disease; the opposite ovary formed a large tumour.

A characteristic change, peculiar for evident reasons to salpingitis, now follows, viz. adhesion to one another of the edges of adjacent fimbriæ swollen by small-celled infiltration. The epithelial surfaces brought into contact become damaged and break down, so that the cells disappear by a secondary process quite unlike what is understood by catarrhal desquamation. The plicæ, however, remain apart near their roots, where the epithelium usually appears quite intact; another proof how little in catarrhal salpingitis it is subject to well-marked primary change. These spaces, formed by plicæ adherent at their free ends, appear in microscopic sections as cystic cavities lined with epithelium. After a time they often become true cysts, when a wide area of plicæ sinks embedded in inflammatory effusion (*salpingitis pseudo-follicularis*). This interpretation of the origin of the pseudo-cysts of salpingitis is not universally accepted. Hoehne (27*a*) explains that diverticula of the tubal mucosa develop as a result of salpingitis, so that a "pseudo-cyst" may really be part of a diverticulum seen in section. The observer should also bear in mind

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[1] The photo-micrographs illustrating salpingitis were kindly taken by Mr. Edmund Roughton and the late Mr. H. Cosens from sections of diseased tubes which I have removed by operation. I have been careful to select cases where the clinical history was very clear.

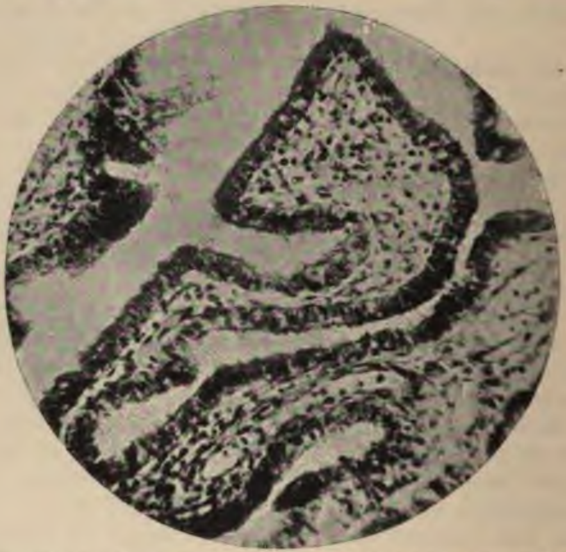

FIG. 124.—Section of a plica from a woman aged 33, subject to pelvic inflammation for about seven years, showing the earlier changes seen in salpingitis. It may be compared with the healthy plica, Fig. 123. Small-celled infiltration has taken place, causing distinct thickening, especially towards the free edge. The epithelium is intact. (¼-inch objective.) The appendages were removed and advanced disease discovered. The portion here seen displays the effect of a recent attack of inflammation over an area which had previously escaped disease.

that the tips of normal plicæ are sometimes united; and teratological diverticula (Whitridge Williams, 65*a*) containing healthy plicæ are not rare in tubes free from any inflammatory change. Sometimes in chronic salpingitis warty growths develop on the mucosa; this is the *papillomatous salpingitis* of Macrez, the *hyperplastic salpingitis* of Le Count (35)—probably the source, as will be explained, of certain new growths.

There may be free bleeding from the surface of the mucosa in catarrhal inflammation of the tube, and to this condition the term *salpingitis hæmorrhagica* has been given. It can hardly be ranked as a special form of disease, but the fact that hæmorrhage may occur in salpingitis is of importance in relation to hæmatosalpinx.

In the middle coat œdema and small-celled infiltration occur, separating the muscular fibres which, as well as the connective tissue, ultimately undergo marked but more or less irregular hypertrophy. Hence the thickening, rarely uniform, and the knotty feeling of the tube. When extremely circumscribed it constitutes the *nodulo-follicular salpingitis* of Reymond (53); in this case a nodule may be wrongly taken for myoma. When the change is extensive in the connective tissue (*salpingitis interstitialis vel diffusa*) the tube becomes extremely thickened; when sclerosis follows, which is frequently the case, the tube grows thinner, but more dense. The infiltration in the middle coat is a factor in obstructing the ostium from within, as will be explained. Sometimes, though seldom, the hypertrophy of the muscular tissue is well marked and almost uniform (*myosalpingitis productiva*). Near the uterine end of inflamed tubes circumscribed areas of muscular hyperplasia have been detected, surrounding isolated cyst-like involutions of the mucosa; this condition is Chiari's *salpingitis isthmica nodosa* (9), and, as in the less localised nodulo-follicular variety, it may simulate a new growth.

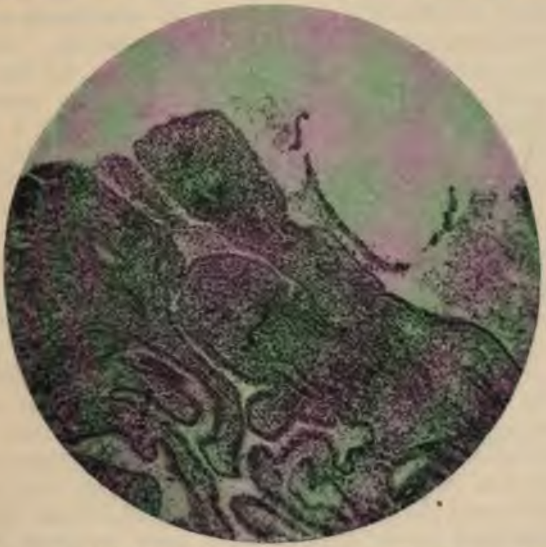

FIG. 125.—The free surface of the interior of a suppurating tube. The plicæ are extremely thickened, but not all fused together. The deeper parts were less vascular than in health; the muscular coat was hypertrophied. From a woman aged 44, subject to symptoms of pelvic inflammation for four years: very severe for four months before operation. Double pyosalpinx was discovered.

Purulent salpingitis is a more severe form of inflammation of the tube. The ostium is usually but not always closed at an early stage; pus may sometimes be seen issuing from the open ostium of an old inflamed tube. The mucous membrane appears extremely congested, discharging pus and mucus. The middle coat increases in thickness, and the serous coat is always invaded. Purulent salpingitis tends to become chronic with frequent subacute exacerbations which, because of the isolation of the tube by inflammatory peritoneal adhesions, entail relatively slight constitutional effects. Under the microscope the plicæ appear markedly thickened by infiltration of round cells (Fig. 125), and reduced in length. The epithelium on the surface loses its cilia and undergoes more or less degenerative change, but it is not invariably shed, nor do the plicæ always become adherent at their tips, as is evident from the appearances seen in Fig. 125, where the disease was chronic and the tube obstructed. Probably the absence of plastic inflammation prevents this adhesion. More often both the epithelium and the deeper components of the free ends of the plicæ are destroyed by the purulent process; granulation tissue replaces them, burying the remainder of the plicæ, yet spaces lined with more or less perfect epithelium may remain deep down under the new deposit (Fig. 126). Adhesion of the more superficial part of the remains of the plicæ denuded of epithelium aids, no doubt, in developing this condition, the suppurative type of *salpingitis pseudo-follicularis*. In purulent salpingitis the middle coat is freely infiltrated with small cells; they lie in spherical or fusiform groups amidst the muscular bundles, which undergo irregular degrees of hypertrophy. In chronic purulent inflammation, great hyperplasia of the connective tissue of the middle coat takes place, sometimes reducing the coat to a thick layer of cicatricial tissue,

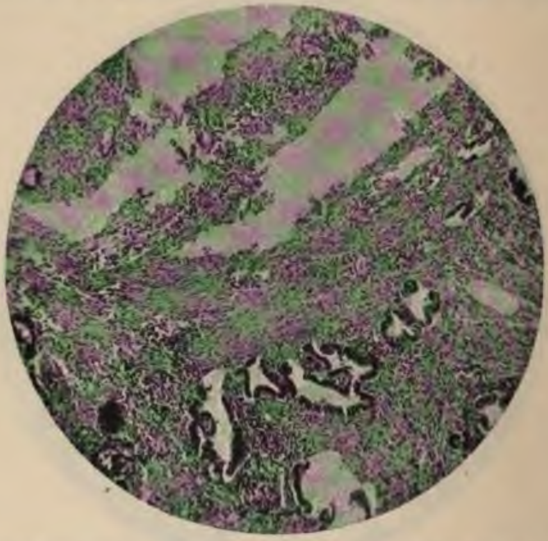

FIG. 126.—Section of a suppurating tube, showing advanced disease. Fusion of the plicæ is complete, and much granulation tissue lies on the free surface of the mucosa. The cysts, or pseudo-cysts, representing the spaces between the roots of the plicæ, have not lost all their epithelium. From a woman aged 26, subject for three years to pelvic inflammation. Seven months before the appendages were removed the curette was applied to the uterine cavity. The patient disregarded advice, got up too soon, and an acute attack occurred with high temperature. Both tubes were found full of pus.

sometimes holding little abscess cavities, or spaces which represent dilated and obstructed vessels. These abscesses and dilatations, with the pseudo-follicles developed in the mucosa, give a characteristic porous appearance to a section of an old suppurating tube, which is puzzling to the observer unless he understands the nature of the spaces. The free ends of opposite plicæ sometimes unite, then the lumen of the tube becomes divided into loculi filled with fluid or inspissated pus.

Changes in the ostium.—The abdominal end of the tube is not necessarily obstructed, even in chronic salpingitis. An open ostium may sometimes be observed in advanced suppurative inflammation (Hartmann, 27), which is one reason why this term must not be used as synonymous with "pyosalpinx." In these cases the general peritoneal cavity is protected from the pus by perimetritic bands near the ostium, which, though actually open, can only pour its contents into a narrowly limited space. As a rule, however, the ostium, even in mild chronic catarrhal salpingitis, becomes more or less obstructed, and more or less permanently closed. The obstruction may arise from without or from within the tube.

To obstruction from without I have applied the term "perimetritic closure of the ostium" (17*j*). In this condition the outer coat, which is part of the peritoneum, is affected. The adjacent peritoneum may be inflamed before the tubal mucosa is attacked. A little deposit covering the delicate fimbriæ as they lie on the surface of the outer aspect of the ovary is sufficient to bind them down, and when the deposit is organised the ostium becomes firmly closed. Diseased fimbriæ are eminently adapted to receive fibrinous deposit (17*g*). Sometimes, on scraping away bands of lymph in the course of an operation, the fimbriæ come in sight, well formed and bright red, being full of blood. In such cases little or no salpingitis may be present, the ovary being the seat of inflammation; more often, however, when the ostium is closed from without in this manner, the tube itself is inflamed, and the perimetritis which causes the closure is the result of extension of inflammatory processes from the tubal canal. This closure of the tube from without must be most effectual in protecting the peritoneum from any further mischief arising from the tubal canal.

The accompanying sketch (Fig. 127) represents a characteristic example of purely perimetritic closure of the ostium. The well-formed and exuberant fimbriæ were packed in a deep pouch on the outer side of the ovary, formed by a firm band of membrane. In the drawing the fimbriæ are displayed as they appeared when pulled half out of the pouch. The ostium, before the parts were disturbed, lay deep in the pouch, completely obstructed. The tube was tortuous, being kinked by some firm perimetritic bands; it was also the seat of salpingitis, but the ostium was not closed by changes in the mucosa.

To obstruction from within I have applied the term "salpingitic closure of the ostium." By causing the accumulation of mucus or pus within, it is the most important agent in the establishment of hydrosalpinx and pyosalpinx. It occurs in a large proportion of cases of salpingitis. The mucous membrane and the middle coat become greatly thickened by inflammatory processes already described; they swell and bulge round the ostium, and ultimately close over it. The fimbriæ do not retract like the tentacles of a sea-anemone; the infiltrated tissues simply close over them till they lie reduced to plicæ inside the tubal canal. A glance at Fig. 128 will show the difference of this form of obstruction from the perimetritic variety. Around the bristle the thickened tubal walls bulge high; the ovarian fimbria, highly œdematous, alone remains outside. The perimetritic bands behind and above the bristle must not be mistaken for fimbriæ. When the bulging structures touch and adhere over the side of the ostium the obstruction becomes very firm. Opitz (44) has shown recently that the limits of the peritoneum at the ostium form a kind of ring, efficient in maintaining its patency in health; but the swelling of the fimbriæ in salpingitis effectually closes the ring, which is very unyielding. In chronic inflammation the tissues of the ring may undergo contraction.

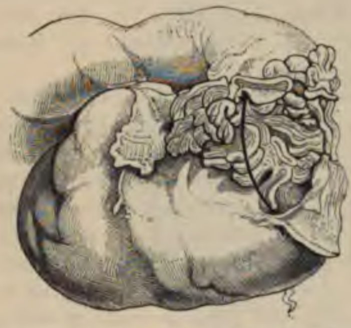

FIG. 127.—Ovary and tube, showing obstruction of the ostium by a perimetritic band which forms a deep pouch. The fimbriæ have been partly pulled out of the pouch. A bristle passes into the pouch out of the ostium.

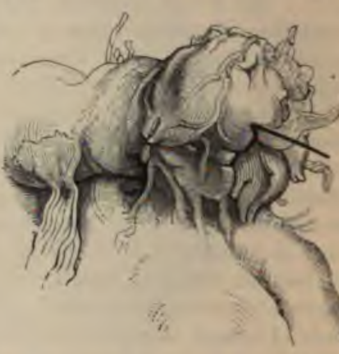

FIG. 128.—Tube showing obstruction of the ostium from inflammatory swelling of its coats. The end of the tube has been drawn up from the ovary and the ostium forcibly opened; a bristle lies in its orifice.

On account of the anatomical characters of the part, stricture of the uterine end of the tube, after the manner in which the ostium is so often closed, is impossible. A firm perimetritic band may press on the outside of the tube near the uterus; more frequently in salpingitis the uterine end is effectually closed, simply by the swelling of the mucous membrane.

The natural tendency of an obstructed tube is doubtless towards cure by spontaneous relief of the obstruction. The liability of the patient to repeated attacks of pelvic inflammation often prevents spontaneous recovery. The effects of unrelieved obstruction must now be considered.

Effects of obstruction of the tube.—The tube when obstructed dilates, forming a hydrosalpinx, a pyosalpinx, or a hæmatosalpinx—conditions which must be considered separately.

Hydrosalpinx (*Sactosalpinx serosa*).—This name signifies dilatation of the obstructed tube by a clear fluid, free from blood or pus. The tube becomes a more or less thin-walled, retort-shaped cyst, which may attain the dimensions of a small ovarian tumour; it opens up the layers of the mesosalpinx until it comes in contact with the ovary (Fig. 129), and coils downwards and inwards below the ovary and behind the uterus. Hence the tense cyst occupying the fornix on its own side, and extending more or less into Douglas's pouch, displacing the uterus forwards and to the opposite side is sometimes easy to diagnose. The cyst is more or less fixed, as it is always more or less adherent to adjacent structures. Hence torsion of a hydrosalpinx (Hamilton Bell,[1] 3*b*) is very much rarer than the same complication in association with ovarian cysts; and the hydrosalpinx does not tend to swing round in front of the uterus, or to fall backwards, till it occupies the opposite lateral fornix, as may occur in the case of a tubal gestation sac which grows rapidly before it can be fixed by adhesions.

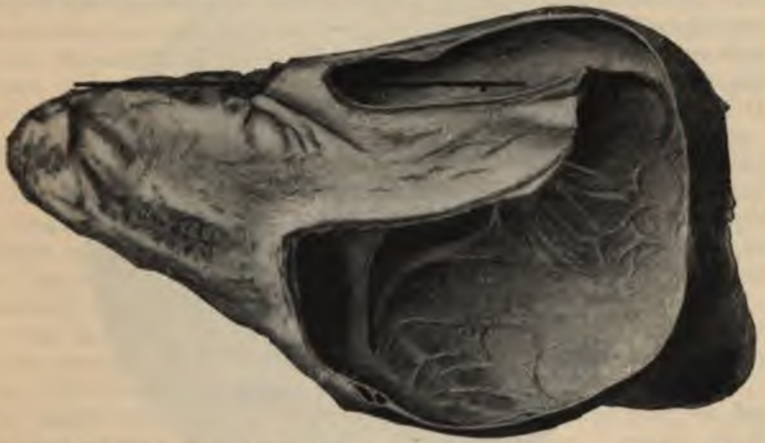

FIG. 129.—A hydrosalpinx. A part of its wall has been cut away to show its interior; the ovary, much flattened, lies to its left. It has opened up the mesosalpinx so that its walls have come into contact with the ovary. A bristle has been passed into the canal of the tube near its uterine end. (Mus. R. C. S. 4572, E. Path. Series.)

The epithelium in a hydrosalpinx undergoes alterations due to pressure (Fig. 130). When the pressure of the fluid is low the changes are but slight; even in an old hydrosalpinx the cilia may sometimes be seen (Orthmann). More often the cells lose their cilia and become cubical, the nuclei appearing relatively large. The conversion of remains of plicæ into papillary or warty outgrowths may lead, as will be shown, to the development of innocent or malignant tumours. In very chronic cases the epithelium may be lost, the mucosa undergoing extreme atrophy. The plicæ are more or less affected by the fluid pressure and by the stretching of the tubal walls. Atrophic changes in the middle coat are well marked. The tube becomes very tense, so that its walls may be transparent. The ovary may be flattened and atrophied, being pressed internally against the uterus, whilst it is encircled above, outside, and below by the tense hydrosalpinx. In a fair proportion of cases, on the other hand, the ovary undergoes cystic degeneration and inflammatory changes, and pushes the hydrosalpinx high up above the pelvic brim.

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[1] When it occurs the symptoms may be so acute as to simulate torsion of the ovarian pedicle or acute appendicitis.

Infection of a hydrosalpinx, converting it into a pyosalpinx, may certainly occur; adhesion to intestine or to the vermiform appendix sometimes brings about this change. It is quite a mistake, however, to suppose that every pyosalpinx is the later phase of a hydrosalpinx. Primary hydrosalpinx (the term indicating that it is not secondary to salpingitis) is an occasional result of inflammation of the ovary; or it may be a complication of uterine cancer, uterine fibroid, or ovarian tumour, through peritoneal irritation setting up perimetritic closure of the ostium. Catarrhal salpingitis is nevertheless the most frequent cause of hydrosalpinx, the ostium being closed by either of the two processes above described. It is doubtful whether a pyosalpinx ever becomes a hydrosalpinx—the purulent contents being replaced by serum. As can be demonstrated by pathological specimens preserved in museums, a hydrosalpinx may open into an ovarian cyst or, more frequently, into a cystic cavity in an ovary subject to chronic inflammation. This is what is meant in nine cases

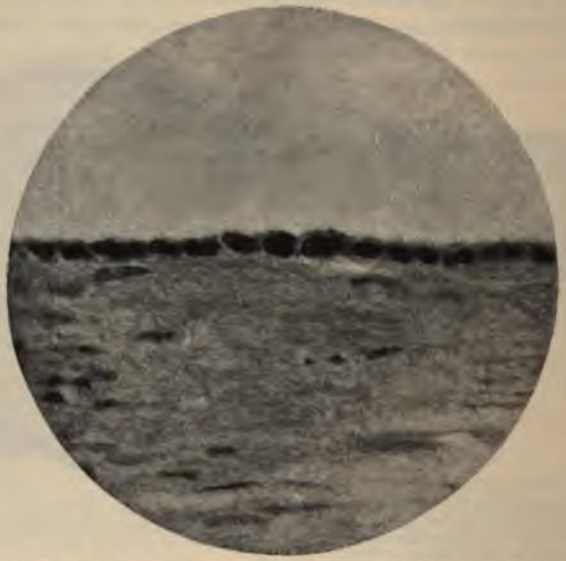

FIG. 130.—Section showing the free surface of the interior of a tube which had been obstructed and dilated for a long period. From a woman aged 42, who had suffered for over ten years from chronic pelvic inflammation. The epithelium has not disappeared, but the cells have become cubical and have lost their cilia. The middle coat is reduced to fibrous tissue; the vessels and muscular fibres have entirely disappeared. (⅙ inch objective.)

out of ten of so-called *tubo-ovarian cyst*. The name has been wrongly given to a large hydrosalpinx, where the plicæ, projecting from the aperture through which the narrower inner part of the tubal canal communicates with the outer part, simulate the fimbriæ of the ostium. As the plicæ are quite effaced on the mucosa of the outer part, which is greatly dilated and bent under the inner part, the outer part is often taken for a cystic ovary. The true ovary in such a case is flattened out between the tube and the uterus. The hydrosalpinx represented in Fig. 129 might easily have developed into a false tubo-ovarian cyst.

Clinically a hydrosalpinx is as a rule associated with a history of pelvic inflammation. The physical signs have been given above. Temperature is no certain guide to the differential diagnosis of hydrosalpinx from pyosalpinx. There may be pus, or conditions causing rise of temperature in other parts of the pelvic organs in a case of hydrosalpinx, whilst pyosalpinx is not rarely associated with a normal temperature. When hydrosalpinx complicates uterine fibroid it usually causes pain, and may sometimes be distinguished as a tender swelling in one of the vaginal fornices. Outgrowths from the fibroid itself are rarely tender.

Pyosalpinx (*Sactosalpinx purulenta*).—This name signifies dilatation of an obstructed tube by pus, more or less pure. It is a common result of tubal inflammation without the intermediate hydrosalpinx. Salpingitic closure of the ostium sometimes occurs very early, so that pyosalpinx may be almost a primary condition; though, on the other hand, as above observed, purulent salpingitis does not always entail closure of the tube.

The most important feature about pyosalpinx is the nature of the germs contained in its pus. For pyosalpinx is very common in association with tuberculous disease, and not rare in cases of uterine cancer; it may result from infection derived from an inflamed appendix, or from decomposed matter retained in the cavity of a fibroid uterus. In the majority of cases, however, it is due to puerperal or gonorrhœal infection. The specific germs associated with these infections often disappear from the purulent contents of the tube within a few weeks; yet reinfection, usually from the bowel,—the germ being the bacillus coli,—may certainly occur. These bacteriological peculiarities account for the grave results which sometimes follow the most carefully conducted operations for pyosalpinx, and for the absence of any serious sequel of similar operations where, through bursting of the tube in the course of its removal, several ounces of pus have been spilt into the peritoneal cavity. The possible conversion of a hydrosalpinx into a pyosalpinx has been referred to already. A pyosalpinx may infect the vermiform appendix.

A pyosalpinx assumes the retort-like form of a hydrosalpinx (Fig. 131). It opens up the mesosalpinx, which it infects; this portion of the broad ligament becomes very thick. As the suppurating obstructed tube may come into communication with an ovarian cyst, or with an inflamed ovary in a state of cystic degeneration, a *tubo-ovarian abscess* sometimes results, homologous to the form of tubo-ovarian cyst described above. The source of fallacy already demonstrated, by which a big pyosalpinx, like a big hydrosalpinx, may be taken for a combination of tube and ovary, must not be forgotten. The tubal wall tends to become thick rather than thin, whilst the serous coat soon contracts firm adhesions to adjacent structures. These changes, prejudicial to the function of the tube, are protective so far as the peritoneum is concerned, and explain why a pyosalpinx, unfortunately a very frequent condition, so rarely bursts; even when that accident happens, the result may be trifling because the pus has become sterile.

The mucosa is mechanically affected as in hydrosalpinx. The epithelium and plicæ undergo the changes described under the heading of purulent salpingitis; and, as in this affection, much epithelium may be preserved, literally buried alive under inflammatory deposit (Fig. 126). There can be no doubt, however, that in an old pyosalpinx the mucosa may be entirely replaced by granulation tissue, which afterwards undergoes cicatricial changes. The epithelium, however, shows great power of resistance. In pyosalpinx associated with tubercle very definite changes, presently to be noted, occur in the mucosa. The middle coat undergoes the atrophic processes seen in hydrosalpinx; but often, as in the unobstructed type of purulent salpingitis, small abscess-cavities are formed in its substance. Œdema is marked; it occurs especially in the subserous connective tissue. The serous coat is always thickened.

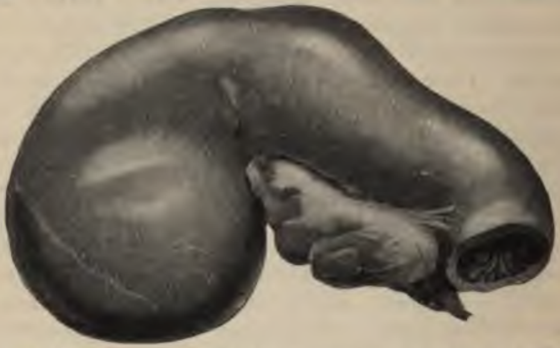

FIG. 131.—A pyosalpinx. It has opened up the mesosalpinx and lies in contact with the ovary. Its walls, as seen in section close to the uterine end, are very thick as compared with the walls of the hydrosalpinx, Fig. 129. From a woman subject for several years to attacks of pelvic inflammation. (Mus. Westminster Hosp. No. 1049.)

In short, in a pyosalpinx, the tubal tissues are, even in the mildest case, thoroughly unhealthy. The danger of leaving the stump of a pyosalpinx as part of a pedicle is therefore evident, and the bad after-histories of patients subjected to removal of inflamed appendages are easy to understand. So likewise can we comprehend why it is sometimes better surgery to remove the uterus than to return it into the peritoneal cavity with the stumps of unhealthy pedicles. Drainage of a pyosalpinx through an incision in Douglas's pouch is a far more rational method. When a history of puerperal, gonorrhœal, or tuberculous infection is associated with pelvic inflammation, and a tense body corresponding in outline to a dilated tube can be defined in one lateral fornix, or in Douglas's pouch, pyosalpinx may be diagnosed. But there are sources of fallacy.

Physosalpinx.—This term may appropriately be applied to a pyosalpinx containing gas, usually the result of decomposition. The gaseous contents may be odourless, as in a case related by Mauclaire (39) where the tubal disease was traced to puerperal infection over a year before the tube was removed. The accumulation of gas had caused severe pelvic pain.

Hæmatosalpinx (Sactosalpinx hæmorrhagica).—This name signifies dilatation of an obstructed tube by fluid or coagulated blood. The great majority of cases are not direct or even indirect results of salpingitis. *Tubal pregnancy* is the usual cause of hæmatosalpinx. A big red or purple, retort-shaped tumour occupying the place of a Fallopian tube almost certainly includes the products of an abnormal gestation. When these cannot be detected, sections of the tubal walls and mucosa should be carefully examined by a competent pathologist. True hæmatosalpinx is also seen in *atresia of the vagina or uterus*, and is associated with a well-known operative peril (*vide* p. 152).

Hæmatosalpinx indirectly associated with salpingitis has been observed in cases of *torsion of a hydrosalpinx* (3*b*); but *the direct conversion of a hydrosalpinx or pyosalpinx into a hæmatosalpinx* is rare, and usually means that the fluid contents are simply stained with blood. "Such a condition may be termed hæmatosalpinx," says Orthmann, and all who are experienced in the pathology and surgery of a Fallopian tube will agree with him in this very qualified opinion about the direct relation of hæmatosalpinx to inflammation of the tube. That relation is so trifling that the matter needs no more discussion here; and for further information about hæmatosalpinx the reader is referred to the sections of this work devoted to "Extra-Uterine Gestation" and to "Malformations of the Genital Organs in Woman."

A kind of *salpingorrhagia*, or hæmorrhage from the ostium, has been noted by Pozzi and others. I have observed free oozing from an apparently healthy tube: this condition is more likely an anomaly of the menstrual function than a result of salpingitis.

Intercommunication of dilated tubes has been recorded. Paltauf's case (47) was defined as double congenital tubo-ovarian cyst, on grounds not absolutely convincing. Gestation occurred in the left cyst, and there was free communication between both cysts and the uterus. Dr. Galabin (24) has described and figured a specimen of double tuberculous pyosalpinx with intercommunication of the cavities of the tubes.

The *bacteriology* of purulent salpingitis and pyosalpinx cannot be discussed at length in these pages. When the infection is puerperal the special germ is to be found in the pus at first, but disappears after a time; the same is the case with the gonococcus, which always dies out in very chronic inflammatory processes, or, as Kraus (34) observes, exists only as involution forms which cannot be recognised microscopically. The bacillus coli seems to play the principal part in reinfection.

Treatment of salpingitis and obstructed tubes.—This subject is discussed in the article on "Pelvic Inflammation" (*vide* p. 517). The warning about operations on a pyosalpinx, given above, should ever be borne in mind; and recovery from an operation of this kind by no means guarantees the patient against grave complications in the stump long afterwards, nor is danger from intestinal adhesions absent. Hence many records of series of successful cases in hospital practice are worse than useless, for they are misleading.

Salpingostomy, a plastic operation on a hydrosalpinx which aims at the framing of a new ostium, is a somewhat doubtful procedure which (among other evident objections) may set up local peritonitis, a complication prejudicial to the new ostium; indeed, it appears that in at least one case a pyosalpinx has subsequently developed. No plastic operation could restore the delicate normal relations of the structures around the ostium disturbed by salpingitis after the manner demonstrated in the above paragraphs on salpingitis.

Tuberculosis of the tube.—Of all parts of the female genital tract it is the tube that is most often affected with tubercle. According to Comyns Berkeley (4), who has examined the post-mortem records of the Brompton Hospital for Consumption, the genital tract was tuberculous in 62 out of 798 subjects; and in 30 out of the 62 the Fallopian tubes were affected.[1] In 172 cases of tuberculosis of the female genital tract, with or without tubercle of other organs, the Fallopian tubes were affected in 157 (Merletti). It is evident when the genital tract is attacked secondarily, that the disease usually begins in the tubes. The question of primary tubercle of the tube is of high interest. The tube, as pathological research has proved, may be infected by tubercle which has already attacked organs far off from the pelvis, so that the pathologist must be careful about pronouncing any one case of tubal tuberculosis as primary. Nor has the disease as a rule ascended from the lower part of the genital tract. Rosenstein (56) finds that the descending form of infection is the most frequent, infection through the blood channels not uncommon, ascending infection very rare. "Even in the apparently primary cases," says Whitridge Williams (65*b*), "it is impossible to exclude blood infection." But this author and also Martin, Orthmann, and Berkeley, agree that tubercle may enter the genital tract through the vagina. The mucosa of this canal is tough, and the uterus may be protected by its endometrium, which is shed at the menstrual period, so that the tubercle bacillus may not be able to work mischief until it reaches the canal of the tube. The bacillus may doubtless be introduced into the genital canal by gynæcological instruments or the examining finger. The question of infection during coitus has been much disputed.

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[1] At the same hospital Dr. Dymock Turner detected tuberculosis of the tubes in 5 out of 25 consecutive necropsies on subjects who had died of chronic phthisis (*Trans. Obst. Soc.* vol. xli. p. 359).

Convincing evidence seems difficult to obtain, for in a case where the husband is tuberculous and the wife's tubes are found infected, it may be that some other organ (such as a bronchial gland, as in Amann's patient), was the seat of primary infection in her case. In Menge's case (40) the husband was known to have genital tuberculosis, but he refused to be examined; and it was ascertained that there was a strong family history of phthisis on the wife's side, and that she suffered in childhood from some malady resembling tuberculous peritonitis. Berkeley, on the other hand, reminds us of Derville's eight very suggestive cases of genital tuberculosis in wives, where in five at least the husband had hard masses in the epididymis apparently of tuberculous origin. The gonococcus, we understand, by destroying the epithelium in the male genital tract, may thereby dispose it to tuberculous infection. Rosenstein appears sceptical about ascending infection even in these cases, as the germs may reach the tubal mucosa through the blood.

Tuberculosis, so frequent in infancy and childhood, may attack the Fallopian tubes long before puberty, as in well-known cases reported by W. C. Chaffey (8) and Quarry Silcock (60). Dr. Cullingworth (12) believes that tubal disease in virgins is generally if not always tuberculous. As in the adult it is seldom if ever possible to prove the tubal disease primary.

Pathology.—Orthmann teaches that in its early stage tuberculous salpingitis cannot be distinguished from the ordinary catarrhal variety. This author and Schramm[1] and Münster (42) also have had the opportunity of examining this disease in its earliest stages, and find that it is the mucous membrane and adjacent tissues that are first attacked. Rosenstein's experience is similar; and Jani detected the tubercle bacillus in the mucosa of a tube from a patient who had succumbed to chronic phthisis and tuberculous disease of the intestine: in this instance the tube was then perfectly healthy (29). Practically speaking, however, when observed on the operating table or in the post-mortem room the disease is more or less advanced; miliary, chronic diffuse, and chronic fibroid types have been distinguished (C. Berkeley). Rarely if ever is the adjacent peritoneum free from infection, whereby the essential nature of the disease is often evident. The specific deposit so familiar to us, studs the serous coat of the tube, and, in exceptional instances when it remains open, issues as a cheesy material blended with mucus from the ostium. In cases less evident from the external aspect of the tube, the presence of the same material in the tubal canal will aid in diagnosis (Fig. 132). The tube is always thickened, and also tortuous, for a reason explained above in the description of catarrhal salpingitis. Sometimes the tube is quite sunk in a sheet of tuberculous deposit which buries the uterus as well. According to Rosenstein's recent observations tuberculosis of the tube is always bilateral.

When the tube becomes infected the formation of *tuberculous pyosalpinx* is the rule, although not invariable. A non-tuberculous hydrosalpinx or pyosalpinx may become infected from the vermiform appendix, or from other primary seats of the disease. The thickened, obstructed tube assumes the form of a banana (C. Hubert Roberts (55)) rather than that of a short pipe or retort. The effects of chronic tuberculous disease of the tubes is well shown in Fig. 133. The process of caseation destroys portions of the wall, so that the pus and tuberculous material in the interior communicate with external structures, and adhesions may be very dense.

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[1] "Zur Kenntniss der Eileitertuberkulose," *Archiv f. Gyn.* vol. xix.

Microscopically, as Schramm (*loc. cit.*) and Orthmann (45*c*) have demonstrated, the acute and chronic forms of tuberculous salpingitis differ in several important respects. It is the bacillus tuberculosis which is to be found in the earliest stage, but later, when the specific germ has vanished, the giant-cells of tubercle prevail. In the acute form the bacillus may be found abundantly in the cheesy matter in the tubal canal. The epithelium is not shed, even when the disease is already definite (Schramm). The cells swell and may lose their cilia, but they are slow to fall. Schramm notes that the epithelium at first appears swollen, and the nucleus, greatly enlarged and spherical, fills up nearly the whole breadth of the cell. This change, however, may be seen in chronic salpingitis independent of tubercle: it is represented in Fig. 130, p. 486. The patient in this case was free from any sign of the tuberculous disease, and remained so when last heard of, ten years after the operation. The essential primary change is a diffuse cell-growth of lymphoid and epithelioid character in the plicæ, which become greatly swollen. The characteristic giant-cells make their appearance. Cheesy metamorphosis of this cell-growth speedily follows, the change beginning

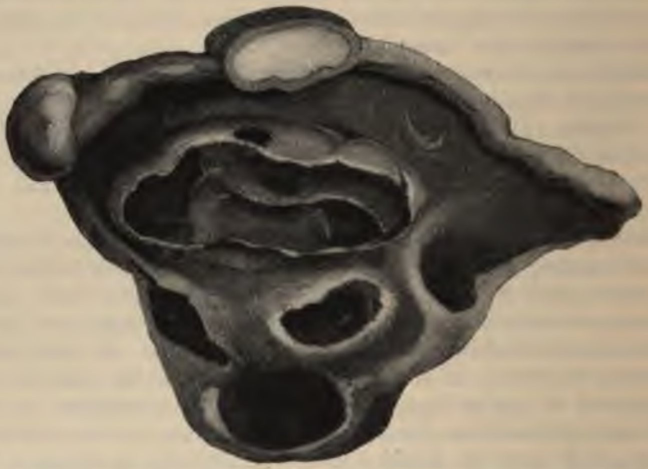

FIG. 132.—A tube and ovary showing tuberculous deposit in the tubal canal at two points. The ostium is closed, yet no great dilatation has developed.

in the nuclei of the epithelioid cells. The caseous changes usually invade the muscular and peritoneal coats.

In chronic cases the epithelium is certainly lost. This change is easy to verify, since chronic tuberculous salpingitis is not rarely met with on the operating table. The plicæ become greatly thickened and infiltrated with numerous tuberculous nodules containing giant-cells. In the earlier stages of chronic disease bacilli may be found in these cells. The mucosa at length breaks down and is replaced by granulation tissue, yet the epithelium lining the deepest part of the mucosa between the attachments of the plicæ often persists as in other advanced forms of chronic salpingitis. In Münster and Ortmann's drawings of chronic tuberculous salpingitis (42) the appearances are much the same as in the chronic non-tubercular form shown in Fig. 126, p. 482; there are the same cyst-like spaces lined with epithelium. The stroma, however, in Münster's specimens is seen to be not only subject to small-celled infiltration as in uncomplicated salpingitis, but it is also infected with giant-cells and other characteristic elements of tuberculous disease. By this feature may any case of advanced chronic tuberculous disease be recognised.

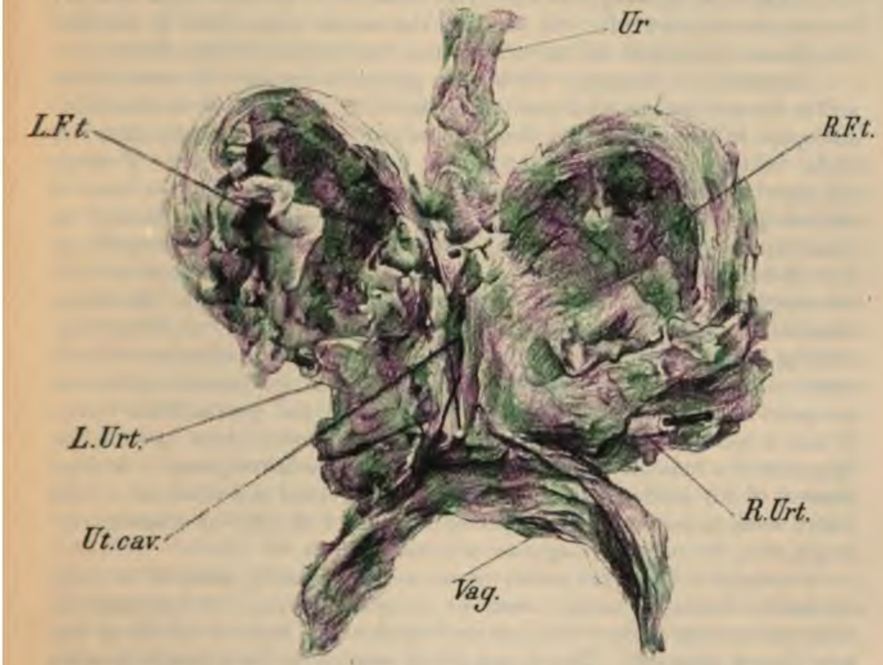

FIG. 133.—Tubes and uterus from a patient who died of phthisis three years after incision of peritoneum infected with tubercle (see *Trans. Obst. Soc.* vol. xxxi. p. 217, and vol. xxxiii. p. 185). *R.F.T.*, *L.F.T.*, Right and left Fallopian tubes. *Ut. cav.*, Uterine cavity. A bristle passed into each tube. *R. urt.*, *L. urt.*, Right and left ureter. *Vag.*, Upper part of vagina. *Ur.*, Urachus, abnormal.

The tuberculous nodules are never limited to the mucosa in a chronic case. They are to be found in the muscular coat where small-celled infiltration and hyperplasia of the connective tissue occur as in ordinary purulent salpingitis. The serous coat may be extensively involved, becoming infested with nodules. It is chiefly on this account that the pathology of the disease is often easy to recognise by the naked eye. Caseation causes the accumulation of cheesy matter in the tubal canal and destructive processes in the tubal walls.

When tuberculous peritonitis exists invasion of the tube from without is easy to understand. So long as the serous coat alone is invaded the disease is tubercle on the tube rather than tubercle of the tube.

Symptoms and Diagnosis.—When the patient is known to be tuberculous and a more or less painful swelling, resembling in character a distended Fallopian tube, is discovered, the chances that the tube is tuberculous are high. Bilateral swelling is the rule, it must be remembered. Profuse and painful menstruation is frequent, but not constant. If in a case of chronic pelvic pain and swelling there be a distinct family history of tubercle, the probability of tubal tubercle must be taken into account. The patients are often sickly, and bear traces of other forms of this constitutional disease, but this is by no means the rule, for large tuberculous tubes may be met with in robust women and healthy-looking young girls. Family histories, too, are often defective. Hence tuberculous tubes are not rarely discovered at an exploratory operation for pelvic disease of unrecognised origin, or in the post-mortem room. When a patient is evidently the subject of tuberculous peritonitis, diagnosis of a mass in each lateral fornix becomes relatively easy. A total absence of any evidence of puerperal or gonorrhœal infection, in a case where there is pelvic swelling with symptoms of chronic or subacute inflammation, favours the diagnosis of tubal tubercle.

Treatment.—The extirpation of an active focus of tubercle is very advisable, hence it might seem to be good surgery to amputate a tuberculous tube. But "extirpation" implies the removal of all of the tube that is diseased. This is usually impossible, as the tubercle invades the adjacent peritoneum at least, and important viscera may be deeply infected as well. To leave two unhealthy stumps attached to the uterus is to expose the patient to great risks. Abscesses not rarely form around the stumps, and even if drained, may discharge so freely that the patient may ultimately die of hectic.

On the other hand, where there is doubt an exploratory incision is advisable, as in many cases of disseminated tubercle the opening of the peritoneum is in itself beneficial. In my own experience it has proved far more satisfactory than removal of the tubes. One patient died of phthisis three years after the exploratory operation; the tubes were found diseased, yet in a quiescent condition (Fig. 133). The drawing shows how extensive may be the damage inflicted by tuberculous disease on the internal genitals. If there be distinct dissemination of tubercle over the peritoneum, removal of the tubes should never be attempted, and when the abdominal wound is closed the peritoneum should always be sutured separately. Deep sutures passing through the integument as well as through tuberculous peritoneum may cause the tubercle to advance along the suture tracks to the skin, a disastrous complication. Drainage of a tuberculous pyosalpinx through Douglas's pouch may be practicable, and has been attended with good results. When the disease seems absolutely localised to the tubes it is better to remove the uterus than to leave it with the diseased ligatured stumps of the tubes.

Actinomycosis of the tube.—Poncet and Bérard in their *Traité clinique de l'actinomycose humaine* state that, according to numerous clinical reports, the ovaries and tubes are often involved in actinomycotic deposits and abscesses derived from the vermiform appendix. Fehmers (23), writing in a Dutch paper in 1901, gives details of three cases of actinomycotic parametritis, in two derived from the appendix, in the third from the ampulla of the rectum. Grainger Stewart believed that in his case of actinomycosis of the ovary the parasite entered through the genital tract. Colonies of actinomyces were found in the pus which filled a dilated portion of the right Fallopian tube. Illich comments on Zemann's case (68), where a cook aged forty died of meningitis following peritonitis; the right tube was converted into a sac as thick as a finger, full of pus and lined with granulation tissue containing actinomyces. Metastases had extended as far as the brain. Zemann traced infection to the genitals, but Illich (28) adds that Israel suspected that the primary seat of the disease was the intestine. Poncet and Bérard have failed to find any other instance of distinct actinomycosis of the tube; and when we bear in mind that an ordinary appendicular abscess may infect the tube, and that actinomycosis of the appendix is relatively frequent, we cannot feel satisfied that primary actinomycosis of the tube has ever been proved, or even that the infection has ever entered the system through the genital tract at all. In one of Fehmers's cases, where there may have been actinomycotic pyosalpinx, potassium iodide is said to have effected a cure. Operative measures are of doubtful value, for in Fehmers's and other recently reported cases of pelvic actinomycosis, appendages, uterus, and intestines were found welded together by dense cicatricial deposit. The surgeon may bear in mind that collections of pus holding the parasite have several times been discovered in the pelvis—but in Douglas's pouch, not in the Fallopian tubes.

Syphilis of the tube.—Martin and Orthmann deny the existence of a true syphilitic salpingitis, and, notwithstanding the industry and vigilance of numerous gynæcologists and syphilographers, not half a dozen examples of undoubted syphilis of the tube have been recorded. Isidor Neumann, in his standard work *Syphilis* (Vienna, 1899), maintains that the salpingitis and "perisalpingitis" (*sic*) often discovered in syphilitic prostitutes are mere coincidences devoid of any specific characters (p. 682). Bouchard and Lépaul, in the case of a syphilitic subject aged forty, found both tubes thickened and bearing three true gummata of the size of hazel nuts. Jeanne, in *La Gynécologie* for April 1904, described a case where within two years masses in the pelvis, possibly tubal, disappeared under specific treatment. The patient, aged forty-nine, had been the subject of syphilis for several years. Dönhoff, and also Ballantyne and Williams, describe morbid appearances in the tubes of syphilitic infants. One or two more doubtful cases have been published. Thus experience teaches that the oviducts, so liable to serious damage from gonorrhœa, are for some unknown reason little exposed to the ravages of syphilis.

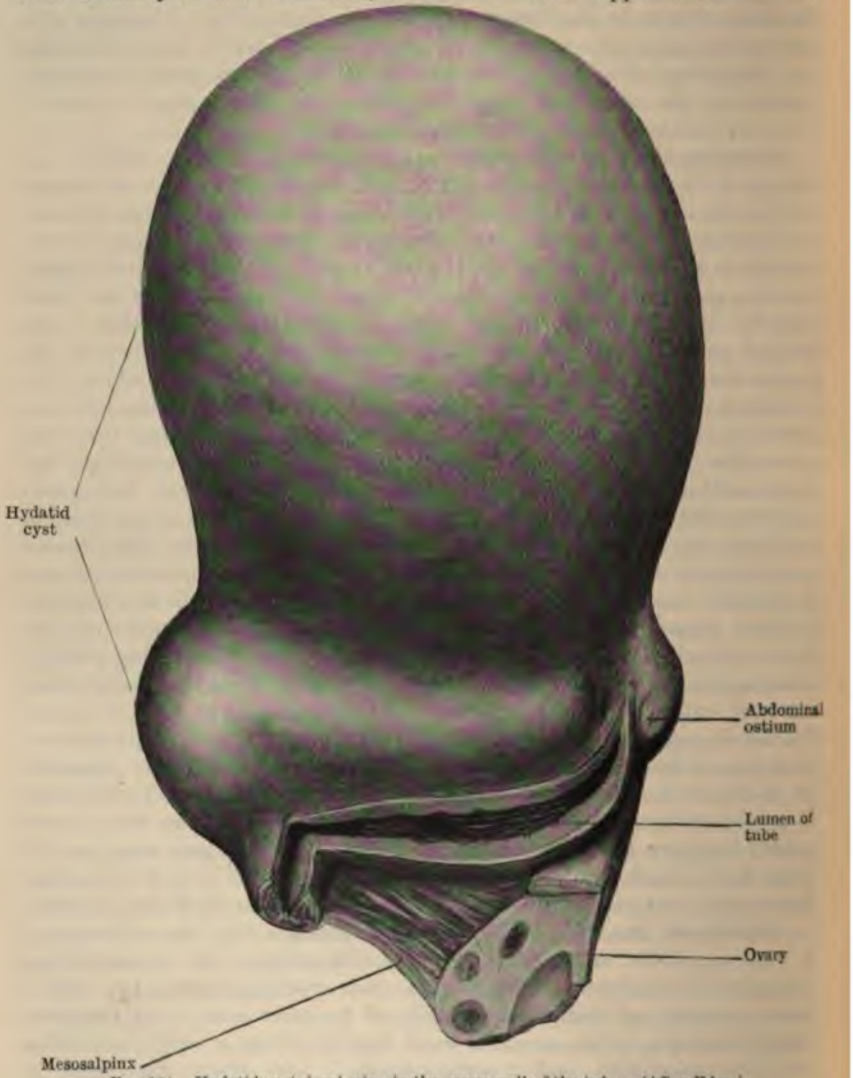

FIG. 134.—Hydatid cyst developing in the upper wall of the tube. (After Eden.)

Hydatid disease of the tube.—Doléris (15*b*) operated on a butcher's wife, successfully removing both her Fallopian tubes, which formed a pair of large convoluted tumours stuffed with hydatid cysts. In Eden's case (19) the patient was a sterile woman aged forty; the tumour (Fig. 134) simulated a small ovarian cyst, and was formed by a single hydatid cyst which had developed in the upper wall of the tube; the canal was not involved in the disease. The subject is fully discussed in Eden's interesting memoir on his case.

Tubal Calculus.—Cullen's case is noted above under catarrhal salpingitis (p. 479). Ballantyne and J. L. Green report a large calculus weighing a little over half an ounce. Green discovered it at a necropsy on a widow, aged eighty, who died of senile degeneration of the heart. It was inside the canal of the left Fallopian tube, and there was no indication of any disease of the pelvic organs. Dr. Ballantyne kindly sent me the specimen for inspection. Its surface was tuberous; its dimensions $1\frac{3}{4}$ inch by $1\frac{3}{8}$ by 1 inch; it was yellow and brittle, and looked like a calcified fibroid, but Green found, I understand, no evidence of any tumour in the tubal wall. Federow's case of loose bodies found in a dilated tube (22) will be mentioned under papilloma of the tube.

TUMOURS OF THE FALLOPIAN TUBE

The histology of the tube and the origin of many new growths in its vicinity require very deep scrutiny, and much remains to be made clear. The writings of von Recklinghausen (52), Kossmann (33), and W. S. Handley (26) must be carefully studied. The first author has written an important monograph on adenomyomatous and cystadenomatous growths in the walls of the uterus and tubes. He traces them to relics of the Wolffian body. Whatever may be their origin, it is certain that minute bodies are sometimes found in the tubal as well as in the uterine wall, which consist of plain muscle-cells and contain minute canals lined with epithelium of high type. Kossmann, on the other hand, believes that relics of the Müllerian duct lie widely scattered beyond the limits of its normally developed portion—the uterus and Fallopian tube, so that, according to his view, papilloma of the broad ligament and even of the ovary may arise from Müllerian or tubal elements, and not necessarily from Gartnerian, Wolffian, or mesonephric relics, as has long been supposed. He instances a case of papilloma of both tubes and ovaries which I have reported (17*c*), and reasonably observes that when a common source is highly probable, we are not justified in ascribing a different origin to two growths identical in character. In the disputed case, however, the tube may have infected the ovary. Let it be remembered that tubular relics of the mesonephron, with which we are not directly concerned, certainly run into the hilum of the ovary,[1] if not farther, and that on the other hand Müllerian relics, all-important in respect to tubal growths in this controversy, also penetrate the tissue of the ovary, mainly proceeding from the ovarian fimbria of the tube, but in part, according to Kossman, arising from detached Müllerian relics on the surface of the tube. Clarence Webster has recently laid stress on aberrant tubal tissue in the ovary, as explaining the presence of decidual cells which he found in ovarian tissue in a case of primary ovarian pregnancy (64).

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[1] See Harz's valuable monograph on the "Histology of the Ovary in the Mammalia" (*Archiv für mikroskop. Anat.* vol. xxii. 1883, p. 374). The course of the Wolffian or mesonephric tubes must not be forgotten by those who maintain that Müllerian relics are to be traced into the ovary.

CYSTS OF THE TUBE

The irregular yellow bullæ sometimes seen covering the surface of the tube and broad ligament in association with large uterine fibroids are not true cysts, but obstructed and dilated lymphatics. When during an operation the adjacent tissues are divided, the lymph drains away and the bullæ disappear.

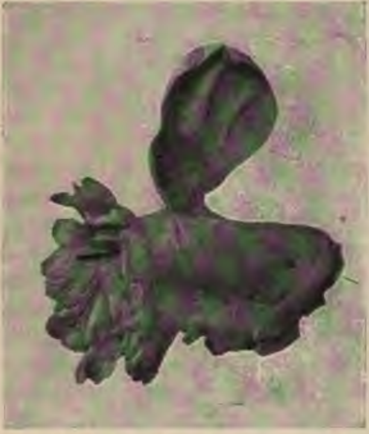

FIG. 135.—Hydrosalpinx of an accessory tube. (Mus. R.C.S. Path. Ser. 4582.)

Small true cysts, more or less pedunculated, are very frequent on the peritoneum of the tube and mesosalpinx, the site of the well-known accessory tubes with fimbriæ which occasionally bear an ostium. According to Kossmann's hypothesis, referred to above, these cysts are developed from accessory tubes. Such a tumour is a "hydroparasalpinx." Handley examined a small pear-shaped cyst projecting from the free surface of a tube near the ostium. He found it to be a hydrosalpinx of an accessory tube obstructed by twisting of its pedicle; its cavity communicated with the canal of the true Fallopian tube (Fig. 135). Its lining membrane had distinct plicæ which, according to Handley, indicated that it was of Müllerian origin. Hamilton Bell (3*a*) recently examined a cyst 3½ inches in its widest diameter connected by a thin pedicle (as well as by inflammatory adhesions) with the upper border of a hydrosalpinx of the right Fallopian tube. On opening the cyst its wall was found to contain well-formed plicæ. This case is of clinical interest, as the tumour had been noticed for two years, and at the date of operation rose over two inches above the right groin. It had caused much pain, evidently by irritation of the adjacent parts, which set up peritoneal inflammation, as evidenced by the adhesions round the cyst. Handley points out that a case of pregnancy in an accessory tube has been recorded by Demons and Fieux of Bordeaux. The small pyriform cysts with pedicles measuring an inch or more in length described by Ott, myself, and others, as hypertrophied hydatids of Morgagni, may, according to the Kossmann-Handley suggestion, be instances of hydrosalpinx of accessory tubes, but the "hydatid" itself comes under this class, being undoubtedly Müllerian, not Wolffian. I have seen it (or a cystic dilatation of a kindred accessory growth) as big as a Williams pear, and in one case I detected marked calcareous degeneration of the cyst wall. Ott figures a "hydatid" of large size (46). Minute, thin-walled cysts are not rarely seen within the ostium on the surface of the tubal mucous membrane. The late Professor Sänger described a case where two masses of cysts and solid growths sprang each from a pedicle apparently derived from a fimbria of the ostium of the Fallopian tube; he kindly permitted me to copy Dr. Barth's sketch of the specimen after removal (Fig. 136). The uterus and adjacent parts, as seen at the operation, were included in the sketch so as to display the relations of the morbid growths. The patient was twenty-six; the tumours were detected after labour, and removed four months later. Their pedicles were simply ligatured and divided, the Fallopian tube itself was not removed. The opposite tube was normal, and the patient became pregnant after recovery. The lobes of the masses were of different colours—white, yellow, or deep red. Sänger ranked this case as cystic fibro-myxoma of the fimbriæ of congenital origin.

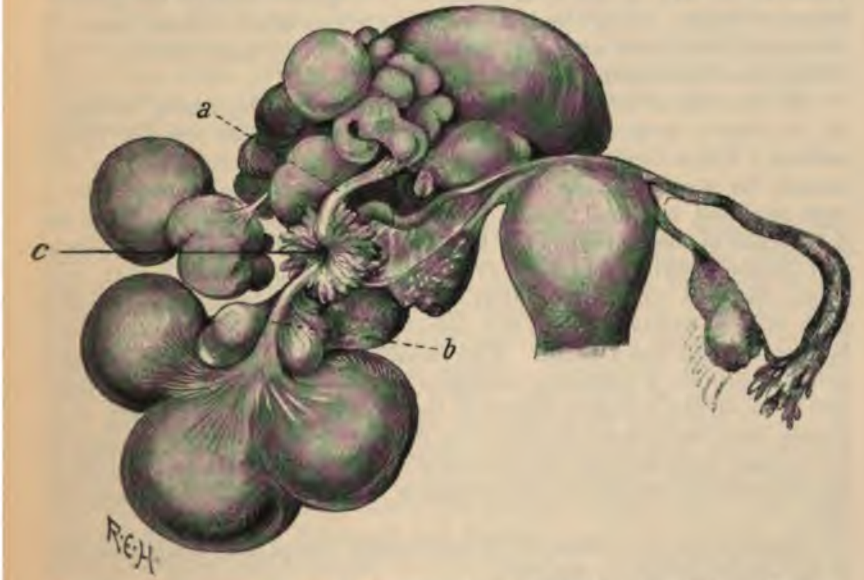

FIG. 136.—Cystic fibromyxoma of the fimbriæ (Sänger). *a*, *b*, Fimbriæ forming pedicles to the cysts; *c*, ostium of the tube.

The mesosalpinx and serous coat of the tube are sometimes covered with a little crop of accessory fimbriæ, amongst which minute cystic structures are almost invariably to be found; the surface of the ovary may be affected. Kossmann attributes the free papilloma of the broad ligament (as well as some, if not all encysted forms) to those structures.

TUBO-OVARIAN CYST

This name has largely been applied in error to a big hydrosalpinx, as explained above. The dilated tube presses the ovary against the uterus, atrophy ensues in course of time, and the ovarian ligament appears to run into the wall of the cyst, which at that point includes the greatly flattened ovary. Hence on microscopical examination ovarian tissue is discovered, and held as proof that the cyst is in part ovarian. The fallacy about the ostium has been exposed above.

Of true tubo-ovarian cysts there are two, or possibly three varieties. In the first a hydrosalpinx opens into a loculus of an ovarian cystic tumour (Walter Griffith (25)). This condition is not common. In the second, far more frequent, a hydrosalpinx or pyosalpinx opens into a cyst produced by small cystic degeneration associated with chronic inflammation of the appendages. By independent investigations Schramm and Neelsen (59) and myself (*Trans. Path. Soc.* vol. xxxviii. p. 241, and *Trans. Obst. Soc.* vol. xxix. p. 302) demonstrated the development of this form of tubo-ovarian cyst. The source of error already indicated must always be taken into account. This remark applies to Mr. Bland-Sutton's *ovarian hydrocele*, a congenital condition where the Fallopian tube opens into a sac on the posterior aspect of the broad ligament, the ovary projecting into the cyst cavity from the floor of the sac. Some specimens in London museums (St. Bartholomew's, St. Thomas's) support Bland-Sutton's theory, others are most probably examples of old hydrosalpinx (25).

Suppuration, and consequently *tubo-ovarian abscess*, may complicate any of the conditions above described.

HYDROPS TUBÆ PROFLUENS

The free discharge *per vaginam* of fluid from a distended tube has, as will be shown, been observed in association with papilloma and cancer of the tube. Bland-Sutton believes that in some cases this clinical phenomenon indicates the presence of ovarian hydrocele. There can be no doubt that a hydrosalpinx does occasionally empty its contents at intervals, but the precise origin and nature of fluid discharged in quantities from the upper part of the genital tract is not easy to determine. In Dr. Skene Keith's case of watery discharge (32) the tubes were found normal.

I have expressed a belief that *hydroperitoneum* may in some cases be due to the irritation of discharge of mucus from a tube with open ostium. In one instance, at least, on which I shall presently dwell, this condition was very marked and its cause visible to the naked eye.

ENCHONDROMA OF THE TUBE

It is not rare to find on the fimbriæ small semi-transparent bodies looking and feeling like fragments of cartilage. Bandl and F. S. Eve (20) declare that they are not cartilage; Eve's specimen is preserved in the Museum of the College of Surgeons (Pathol. Ser. No. 4584*a*). Thiébault of Brussels, however (*Annales de l'Institut St. Anne* 1895), examined a little tumour of the size of a hazel-nut incorporated with the serous coat of an old, thickened, tortuous Fallopian tube close to the ostium which was obstructed. It was gristly in consistence, and on microscopical examination appeared as pure hyaline cartilage with large and small cells; it was undergoing softening and calcareous degeneration in the centre. A tumour of this kind seems allied to a dermoid, or rather to an embryoma (Orthmann).[1]

LIPOMA OF THE TUBE

I have detected true adipose tissue under the mucous membrane of absolutely healthy tubes in young subjects, and therefore see no reason why a lipoma should not develop in the substance of the tube. On the other hand, a distinct deposit of fat is sometimes seen between the folds of the mesosalpinx, just below the outermost part of the tube, following the ovarian fimbria. Rokitansky first recognised this condition. I once observed a very dense layer of granular fat in that position; there was an ovarian dermoid on the same side (17*e*). In a specimen of papillomatous ovarian cyst I found an oval, fatty tumour, barely half an inch in diameter, hanging by a distinct pedicle from the Fallopian tube close to the root of the ovarian fimbria (17*j*). This little tumour, according to Kossmann and Handley, would be a lipoma of the tube, as it arose from Müllerian or tubal elements. Parona's specimen (48) is of much interest; it was procured at an operation where the appendages were removed from a woman aged thirty-seven, for the relief of uterine fibroid. From the original description it is clear that the fatty tumour, which weighed nearly three oz., lay between the folds of the broad ligament. In a drawing the tube is represented laid open, winding on the surface of the lipoma. The tubal wall was "partially buried" in the fat; traces of its mucosa with ciliated epithelium ran through the adipose tissue, hence the lipoma may have really originated in the tubal wall: but it more probably arose from the adipose tissue in the mesosalpinx mentioned above and infiltrated the tube.

MYOMA AND FIBROMYOMA OF THE TUBE

Quénu and Longuet (51) in 1901 tabulated fourteen cases of tubal "fibroid"; Carrière and Legrand (7), who bring the total up to eighteen, express some doubt about at least half a dozen of the reported cases. For details and references the reader is referred to the above-named authors. Simpson's and Schwartz's tumours might have been pedunculated fibroids of the broad ligament, not of tubal origin. Turning to minute myomas, they may represent certain changes in the muscular coat already mentioned as a feature in salpingitis. Quénu and Longuet go so far as to classify tubal fibroids after the uterine types. The *subserous tubal fibroid* is usually pedunculated (Le Dentu), and the pedicle may undergo torsion (Birette), or may be sessile and open up the broad ligament (Bland-Sutton); an obvious source of fallacy about the pedunculated type has just been noted. The *interstitial tubal fibroid* (Spaeth, Quénu and Longuet, Carrière and Legrand) causes a more or less regular increase in the muscular coat of the tube. In Carrière and Legrand's case the tubal canal passed exactly through the centre of the fibromyoma, a small, painful swelling diagnosed as ovarian. The *submucous tubal fibroid* is a variety founded on one remarkable case described by Wettergreen. The tumour was, according to the author's interpretation, a true fibroid polypus of the tube protruding from the ostium, but decidual tissue was detected in its base, and for other reasons it seemed as though it were more or less a product of tubal gestation. Possibly Ballantyne's large tubal calculus already described was a *calcified tubal fibroid.* Pain and metrorrhagia have been noted in several cases of tubal fibroid. The *treatment* is removal, and when the tumour is pedunculated the tube may be spared.

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[1] For recent views see Wagner, "Ueber Verkalkung in den Fimbrien der Tuben," *Archiv f. Gynäk.* vol. lxxiv., 1905, p. 645.

DERMOID TUMOURS OF THE TUBE OR EMBRYOMA

Nearly forty years ago Dr. Ritchie (54) reported a case of tumour in a tube attached to a cystic ovary. The tumour was of the size of a plum, and contained four loculi, each of which held a creamy fluid. "Dendritic growths" sprang from the lining membrane, and on the wall of the tumour was a plate of bone an inch and a half by half an inch broad. An important monograph on dermoid or embryoma of the tube (45*b*) was published by Orthmann in 1904. He puts aside the concretions of fatty matter and lime salts sometimes found in the canals of old inflamed tubes, and compares them with the chalky deposits on the fimbriæ noted by Lawson Tait, Sänger, and myself (17*g*). The alleged examples of enchondroma are more probably allied to embryoma. Orthmann reviews four cases of embryoma of the tube. The first, Pozzi's, is figured in this author's well-known handbook, without a clinical history. Pozzi and Latteux informed Orthmann, on inquiry, that the patient, aged thirty-three, had a tubal gestation sac on the right side; the left tube contained a true dermoid growth. Both ovaries showed small cystic degeneration with no trace of any dermoid structure. Jacobs removed a myomatous uterus from a woman aged forty-eight; the left tube bore what this writer considered to be a diverticulum containing fat and lime salts; the corresponding ovary was normal. This case is doubtful; there was old-standing inflammation, and the fat might have been simply free deposit in the tubal canal. Noto (43) reports a case where a tube and ovary were removed from a woman aged twenty-five; the tube was the seat of a dermoid growth; sebaceous glands were found developing in the mucosa. The opposite tube and ovary were amputated; neither ovaries bore any dermoid growth. Orthmann considers that Noto's case was an eminently authentic instance of true dermoid of the Fallopian tube, and adds full details of a case of his own, already reported in 1902, where a dermoid tube containing hair and a tooth was removed from a woman aged thirty-three, subject to pelvic inflammation for many years. The same writer includes as rather doubtful Treub and Schowman's case, where the right tube ran into a tumour containing hair, the corresponding ovary being normal. Future pathologists in discussing the pathogenesis of dermoid of the tube must take into consideration Shattock's important paper on the nature of the so-called dermoid cysts of the ovary and testicle, read before the Pathological Society of London in November 1904. The *treatment* of tubal dermoid is removal of the tube. In two cases, at least, there were old adhesions, and the tube, it appears, is easily ruptured during extraction.

PAPILLOMA OF THE TUBE

The literature of this class of tumour and of primary cancer of the tube has grown very voluminous since 1879, when I applied the term papilloma to an exuberant morbid growth which lay in the interior[1] of a Fallopian tube, and since 1888 when Orthmann detected true primary carcinoma in a tube removed by Martin. In my own case it seemed that the cauliflower mass might be of inflammatory origin; and, as Le Count has observed (35), the after history has shown that it must have been utterly devoid of the least tendency to malignancy. But in Eberth and Kaltenbach's case of a papillomatous tumour (18) there appeared to be no evidence of malignancy on microscopical examination; nevertheless, from details kindly furnished to me by Professor Von Herff who followed up the case, I found that recurrence took place within eighteen months. Macrez (36) has distinguished a papillomatous endosalpingitis, forerunner of papilloma as a tumour. As above said, and as further evidence has attested (Paltauf, in Fabricius's case), cancerous degeneration of this product of inflammation may occur.

On the other hand, Mr. Bland-Sutton claims to have proved that "papilloma" of the tube is pathologically an adenoma. Eckhardt, Friedenheim, Tuffier, and Witthauer doubt the inflammatory origin of primary cancer. Stolz (62) reviews the debated question impartially. For my own part, whilst I believe that the evidence of previous inflammatory changes in cases such as I have quoted above cannot be gainsaid, I admit that in other instances a true wart in a tube free from salpingitis may have been the origin of the papilloma; moreover, I think it conceivable that cancer may develop from the epithelium of the tube independently of inflammatory products, or from warts of any type. At any rate papilloma, whatever it may be, and carcinoma of the tube are inextricably mixed up with each other. Nevertheless papilloma must be considered specially. About sixteen cases have been published. Macrez's monograph (36) is of high value. Quénu and Longuet tabulate six as papilloma and eight as adenoma, not including one reported by J. G. Clark (10) in the *Johns Hopkins Hospital Bulletin* for July 1898, and two more by Lovin and Czirezon referred to by Federow of Warsaw (22). This writer, in examining a cancerous uterus removed from a diabetic woman aged fifty-four, found that the right tube, dilated and obstructed, contained over a dozen solid round or polygonal bodies, some as big as a small bean, which were, according to microscopical examination, papillomatous growths broken off from the tubal mucous membrane. The tubal tumour described by Kretz may have been a papilloma undergoing malignant degeneration, but no after history has been published. Le Count classes it under carcinoma.

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[1] Papillomatous growths on the serous coat are not included in this class, which is confined to papilloma *in* the tube.

In 1879 I published the history of an interesting case of papilloma of the tube (17*a*). The patient, a thin and emaciated maiden lady aged fifty, underwent removal of the tube in April 1879. Mr. Bickersteth kindly informed me in October 1904 that she was certainly alive and well in 1902, and he then believed that she was still living. He treated the patient for symptoms of inflammation of the right ovary two years before Spencer Wells removed the tube. The right pleura was tapped for effusion a few months later; within a year the pleura was tapped a second and a third time, and the abdomen three times. Spencer Wells tapped the abdomen for the fourth time about a month before he operated; 22 pints of ascitic fluid were removed, and I detected clusters of large cells, many undergoing vacuolation, in the sediment. Dr. Caton had discovered similar cells in deposit from the pleural fluid. At the operation the peritoneal cavity contained 17 pints of amber-coloured fluid; a tumour of the size of a large orange lay to the right of the uterus; it was removed together with the right ovary. No secondary deposits could be found on the parietal or visceral peritoneum notwithstanding the most careful search. Four months later the patient suffered from an attack of pleurisy without effusion. Twenty-three years after the operation she was in excellent health. The parts removed by operation, now in the Museum of the Royal College of Surgeons (Path. Series, No. 4584), consist of the Fallopian tube, extremely dilated, and the ovary, which is normal (Fig. 137). Cauliflower masses sprouted from all parts of the mucous membrane of the tube. The uterine end admitted a bristle which could be passed through the entire tube and out of the ostium. A thick mucoid material issued from the ostium, which was abnormally patulous. This condition was also observed in Le Count's case of primary tubal cancer.[1] Le Count, who believes in "the imperceptible transition of hyperplastic processes of the tubal mucosa—belonging properly to the salpingitides—into those of true tumour growths," considers that it is more reasonable to rank my own case, described above, as hyperplastic salpingitis[1] than as tumour. I myself must strongly incline to the salpingitis theory; and since papilloma is sometimes, at least, the result of salpingitis and, on the other hand, may undoubtedly undergo malignant degeneration, it is reasonable to extend this theory, and to ascribe an inflammatory origin to primary cancer of the tube through an intermediate stage of papilloma.

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[1] Any kind of papilloma will cause ascites.

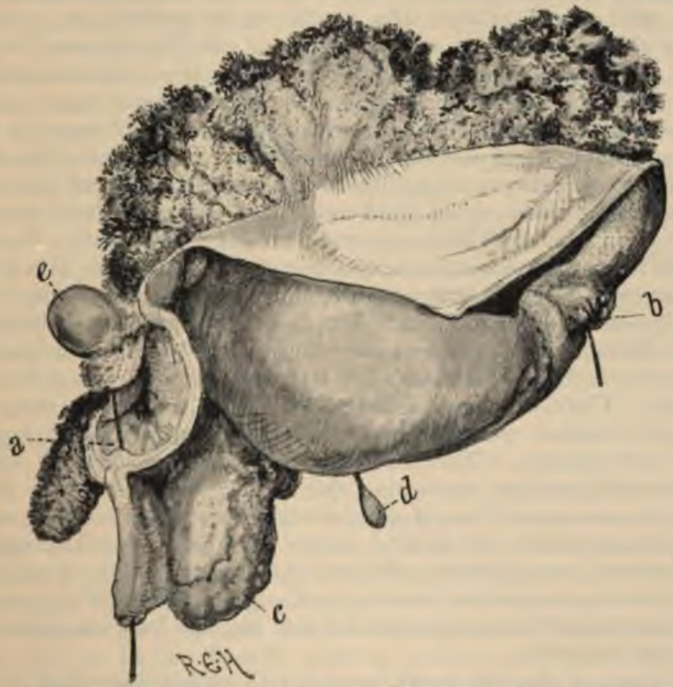

FIG. 137—Papilloma of the Fallopian tube. Case 1. The tubal wall has been divided along its upper border and turned back, exposing the papillomatous masses springing from the mucous membrane. A bristle, entering the cut uterine end, passes along the tube amidst the growths, and emerges at *b*, the ostium. The tube is undilated as far as *a*; *c*, ovary; *d*, small pedunculated cyst; *e*, cyst developed amidst the papillomatous growths.

Doléris's case (15*a*) was clinically the opposite of mine. The ostium was closed and the uterine end patulous, sero-sanguineous fluid in great quantities came away from the vagina, drenching the patient's clothes. She was a young woman of irregular habits, and there was a long history of vaginal discharge, and of attacks of pelvic inflammation. Thus there was true "hydrops profluens" in this case such as was noted in Miknoff's, Routier's, and Boursier and Venot's cases of primary tubal cancer; the sanguineous nature of the serous discharge was of evil omen. Yet five years after the operation M. Doléris informed me that his patient was still quite well and free from recurrence.

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[1] Slaviansky would describe it as a *sactosalpinx papillomatosa*, Le Count reminding us, however, that that authority does not clearly distinguish between papilloma as a tumour and polypous hyperplasia due to chronic inflammation.

In the paragraphs on tumours of the Fallopian tube in general, I have already referred to Kossmann's opinion on a case of papilloma of the tubes and ovaries reported by myself. Long-standing inflammatory disease had existed (17*c*). The papillomatous growths had probably invaded the ovaries from the tubes. In J. G. Clark's case (10) the history of previous inflammation was very clear; the ovary was perfectly normal. Doléris and Macrez (16), on the other hand, report an instance of a tumour in the right iliac fossa which vanished about once in three months, reaching its former size in three weeks; it was a true papilloma of the right tube; its canal was blocked at the uterine end, but the ostium was apparently patent. The fluid must have discharged into the peritoneum, as in Spencer Wells's case, and undergone absorption. We must add that the patient, a multipara aged thirty-seven, had never been laid up with any malady resembling pelvic inflammation. In Dr. Walter's case, carefully described by Mr. Bland-Sutton, there was ascites and the ostium was patulous. Bland-Sutton ranks the tumour as an adenoma, but the history seemed defective, and the patient did not recover from the operation. Clark, Sänger and Barth, Le Count, and others, deny that tubal papillomatous masses are ever adenoma, but Quénu and Longuet admit the distinction. The recognition of a definite adenoma depends on unsettled questions concerning the histology of the tube. Bland-Sutton claims a second case of adenoma in his own practice; the ostium was open, but there was neither ascites nor discharge. The opposite tube, however, was apparently the seat of old inflammation—a somewhat suspicious circumstance in relation to the pathogenesis of the tumour. The patient was, Mr. Bland-Sutton informs me, free from recurrence four years after operation.

Papilloma of the tube seems, according to records, rarer than primary cancer, which implies that it is apt to undergo early malignant degeneration. *Clinical diagnosis* cannot be made with accuracy. When a papilloma of the tube is detected in an exploratory operation, the *treatment* is complete removal of the tube. Wells's case and others show that it is not always bilateral, but the opposite tube must be carefully examined. Should the tumour seem of doubtful nature, removal of the uterus with both tubes may be the best course,—the experiences of Kaltenbach and Fabricius, presently to be related, serving as a warning to the operator.

CANCER OF THE FALLOPIAN TUBES

Secondary cancer.—This name has been employed inaccurately to signify simple extension of malignant disease from the uterus or ovary. A good instance of this extension of cancer from the uterus is described and figured in Sir John Williams's *Harveian Lectures*, 1886. Ballantyne and Williams (1) report a case of cancer of the tube as "secondary" in the strict signification of the term; Scanzoni's was also probably secondary.

In cancer of the ovaries the tubes, as a rule, are not involved till very late, if at all. I have repeatedly found a tube quite healthy when the corresponding ovary had become a large, malignant tumour. Schroeder, and also Ballantyne and Williams, note this clinical point. Sänger (58, 37) describes a case of cancer of the ovaries extending to the tubes, which though distinctly infected remained quite small. In Boxall's case of cystic fibroid with carcinoma of the left ovary (6), a small cancerous nodule no larger than a cherry stone was found on the fimbriated end of the right Fallopian tube. In the interests of accuracy concerning primary cancer of the tube we must never forget how Fabricius (21), Winter (66), and others, have shown that when a hydrosalpinx or pyosalpinx lies in contact with an ovary the seat of primary cancer, the new growth may extend into the cavity of the dilated tube.

Primary cancer.—In the above observations on papilloma the relations of the growth to salpingitis on the one hand and to primary cancer on the other were discussed. Since the first edition of this work was published, over sixty cases of primary cancer have been reported, so that the existence of such a disease is well authenticated, and it is no longer convenient nor necessary to consider every report severally. Important monographs on series of cases and on the subject as a whole have been written by Sänger and Barth (see Martin (37)), Danel (13), Zangemeister (67), Stolz (62), Le Count (35), Quénu and Longuet (51), and Peham (49)). I have published full references to the special and general literature of the subject in "A Table of over Fifty Complete Cases of Primary Cancer of the Fallopian Tube" in the *Journal of Obstetrics and Gynæcology of the British Empire* for October 1904 (vol. vi. p. 285).[1]

Orthmann (45*a*) reported the first authentic case of primary cancer of the tube in 1888. Shortly after its publication I had the advantage of being present when the second case underwent operation (17*d*). The tube itself (Fig. 138) is preserved in the Museum of the Royal College of Surgeons, No. 4584 D. The patient was forty-eight, her only confinement had taken place when she was twenty-six. For three years she had been subject to a watery, inoffensive, and occasionally sanious vaginal discharge. I laid stress on this interesting symptom at the time; in twenty-four out of sixty-two cases since reported a watery discharge, sanious in fifteen at least, was noted. In one case, where "no discharge" was specifically registered, several ounces of clear lemon-coloured fluid were pent up in the dilated cancerous tube (Danel and Delassus (13)); this would have meant watery discharge had the tube been able to empty its contents into the uterus and vagina. In Briggs's case there was "no discharge," but ascites was present, possibly caused by the escape of some fluid out of the ostium, as in the case of papilloma which I have above described. In the case under my own observation, an attack of pelvic inflammation followed the employment of the curette about one year before operation. As the symptoms and pain subsided a tumour was discovered rising to the right above the pubes; it grew slowly, but the patient lost flesh. Knowsley Thornton operated, removing a dilated tube of considerable size, which contained several drachms of ill-smelling bloody serum. Witthauer, Boursier and Venot, and others, have reported bloody fluid in cancerous tubes. The patient died from recurrence nearly eleven months after the operation. The cancerous tube when emptied of its serum measured five inches in length. Almost the entire mucous membrane was covered with a soft and highly villous growth of a bright red colour while fresh. The morbid appearances are shown in Fig. 139, I. The tubular structures seen

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[1] One case was overlooked and should be tabulated thus:—*Age* fifty-five, married, menopause at fifty. *Symptoms:* hypogastric pains four months, relieved temporarily by yellow discharge streaked with blood; mass in left fornix. *Operation; result*, removal of small cysts of left broad ligament and left ovary, with *left* tube dilated externally to size of small egg, and containing isolated malignant papilloma. Death two years and one month after operation. *Operator and reference*, Dr. Mary Scharlieb, "Primary Malignant Disease of Ovaries and Tubes," *Medical Magazine*, vol. ix. p. 240. The after history was traced by Dr. L. Woodcock. For a pathological report, by C. Lockyer, with drawings of a cancerous tube, see H. Macnaughton-Jones, *Diseases of Women*, 9th Ed. p. 678. Unfortunately the clinical history was lost.

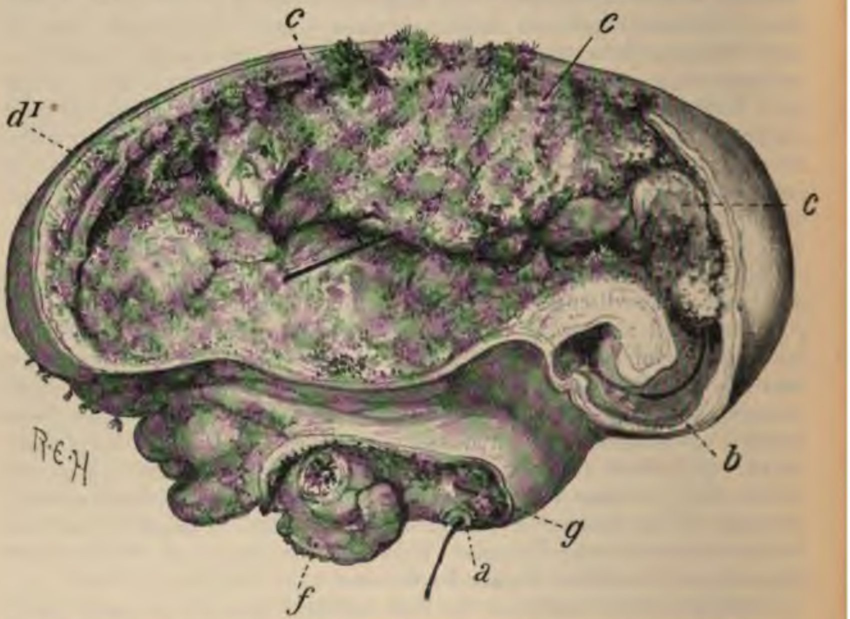

FIG. 138.—Primary cancer of Fallopian tube. Case 2. *a*, Uterine end of tube divided at the operation. A black bristle has been passed through it along the channel of the tube. *b*, Portion of the tube near the uterine end free from growths; *c*, *c*, *c*, masses of cancerous growth springing from the inner surface of the tube; *d*, new growth invading the muscular coat, which is elsewhere mostly free from disease; *f*, ovary converted into a mass of tumour substance; *g*, cut surface of broad ligament, which is infiltrated with new growth.

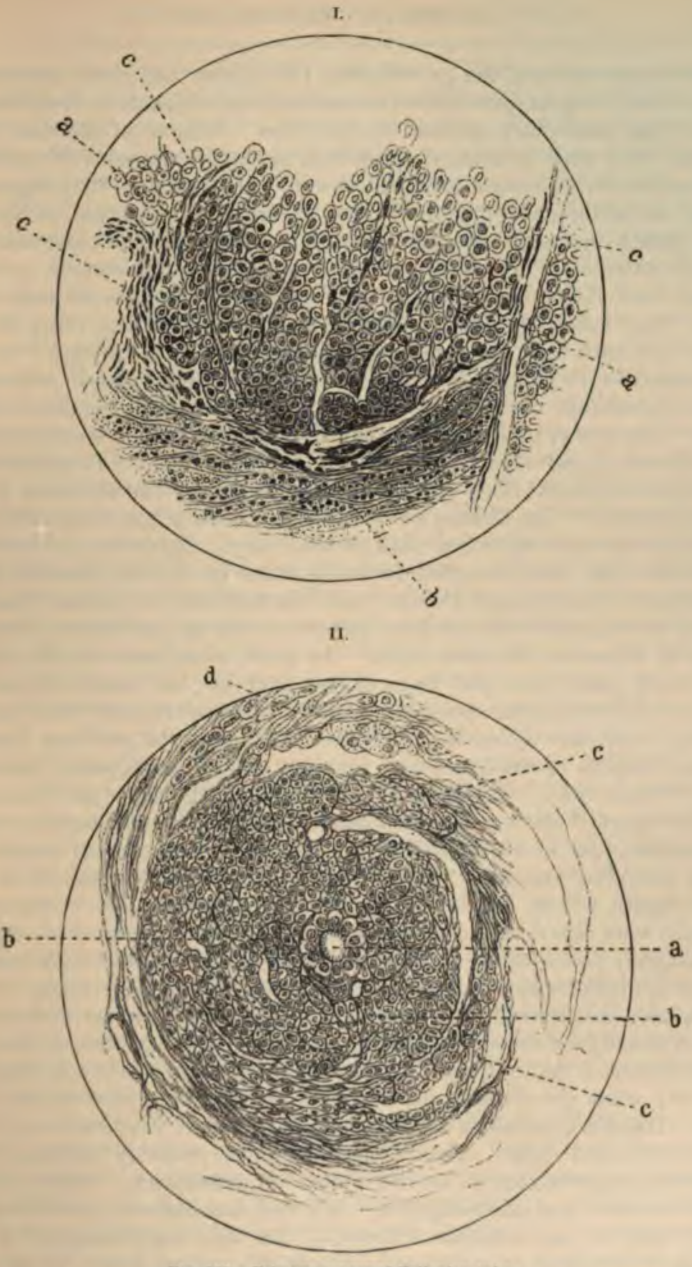

FIG. 139.—Primary cancer of Fallopian tube.

I. Section of cancerous growth invading the wall of the tube (⅛th inch objective). *a*, *a*, Large polymorphous cells; *b*, part of a trabecula, bounding the group of cells, showing small cell infiltration; *c*, *c*, *c*, muscle-cells indicating remains of the muscular coat of tube.

II. Tubule-like structure *a*, seen in cancerous growth (see text). It is lined with cylindrical ciliated epithelium. Large cells, *b*, *b*, surround the tubules; they are arranged somewhat spirally, and prolonged outwards into the stroma at *c*, *c*. Farther on, at *d*, are larger cells.

in the deeper parts of the growth (Fig. 139, II.) are not easily interpreted. Quénu and Longuet have since detected tubular elements in the substance of a large medullary cancer of the tube. Senger of Breslau noted tubules lined with cylindrical epithelium in the deeper parts of a primary sarcoma of the Fallopian tube, and traced them, as von Recklinghausen would do, to the parovarium. Professor Sänger, commenting on Senger's case, insists that such tubules are not glands, as Senger maintains, but simply outrunners from normal plicæ or from papillomatous growths. Eberth and Kaltenbach, as well as Fabricius (21*a*), have already noted these false tubes, doubtless identical with the Wolffian relics of von Recklinghausen and the teratological diverticula of Whitridge Williams, mentioned above under salpingitis. Hoehne (*vide supra*) might trace them to the diverticula which he considers to be the result of chronic salpingitis. The ovary, much smaller than the diseased tube, adhered strongly to adjacent structures; it was removed with the tube. It appeared to be made up of collections of large cells bounded by trabeculæ, as in the tubal growths. The disease seems clearly to have originated in the tube, where it was more advanced than in the ovary. Infection of the ovary by contact has been recorded in other cases by Pilliet, Mercelis, Stolz, Danel and Duret, Briggs, Peham; and less definitely by others. Cullingworth, Peham, and Arendes have observed infection of an ovarian cyst from an adjacent cancerous tube.[1] In most other cases of the disease the ovary was quite free from cancer, and in that which I described the clinical symptoms pointed to tubal disease rather than ovarian tumour, and the appearances of the parts removed did not indicate primary disease of the ovary and invasion of a hydrosalpinx (Fabricius, 21*b*, Winter, 66). Dr. Amand Routh kindly brought me the pelvic viscera removed after a patient's death. The uterus was healthy, except its endometrium which, as well as the mucosa of the cervical canal, bore small secondary deposits. There was infection of the stump of the left appendages, which had been removed at the operation. Cancerous growths were also detected in the bladder, vagina, and lumbar glands, and in Douglas's pouch at the point of adhesion of the diseased right ovary.

In the collected records of over sixty cases of primary cancer of the Fallopian tube, refered to above, many instructive facts are to be found. I have already dwelt on the most important symptom, a watery discharge often sanious. As to *age*, thirty of the patients were between forty-five and fifty when the disease was detected, and eighteen between fifty and sixty. Hurdon's patient was sixty-three, Pawlik and Nový's seventy,—the oldest recorded age. These elder patients probably suffered from cancerous degeneration of an old hydro- or pyosalpinx. Eight patients were between forty and forty-five. We find four between thirty-five and forty, but in one instance (Mercelis) the age was doubtful; in the youngest (Friedenheim) the patient was only thirty-five. Thus there can be no doubt that primary cancer of the tube is most frequent at and for a few years after the menopause. The catamenial histories are seldom accurate; thirty-six patients were reported as having been once or oftener pregnant, sixteen as sterile; so making allowance for ten cases where no record is to be found of sterility or the reverse, it still seems clear that parous women are the more subject to tubal cancer. The disease was *bilateral*, according to twenty-four reports; hence it is highly probable that in other instances incipient cancer in one tube was overlooked. Of the cases reported as unilateral the right tube was affected in twenty, the left in seventeen; in one case the side is not given.

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[1] In other cases recorded by Graefe, Dirner and Fonyó, Herman and Russell Andrews, and Zangemeister, the ovarian cyst was not infected.

Duration of symptoms varies considerably, four cases were essentially acute, with a history shorter than one month before operation (Warneck, Eckhardt, Watkins, Zangemeister), and in all four *dysuria* was noted, a symptom by no means the rule in cases of longer standing. In over thirty patients the symptoms had been observed for under one year and over two months. Of special importance is the duration of sanious and watery discharge above mentioned. In Kaltenbach and Eberth's case it had been observed for four years, and the evidence of malignant degeneration of an innocent papilloma was in other respects very strong; in Thornton's, which I have described above, the discharge had lasted for three years, and in Boursier and Venot's there had been pelvic pain for the same number of years, and sanious watery discharge for nearly as long. *Pain* is reported in thirty-nine out of sixty-two cases; its seat was the pelvic, iliac, or hypogastric region. Crampy or colicky pains were noted in two cases—one was Jacobson's and the second Miknoff's, in which instance a hypogastric swelling was observed to disappear after each attack; "serous leucorrhœa" existed. These symptoms indicated tubal disease of the *hydrops profluens* type, akin to Doléris's case of papilloma. In one case only (Danel and Delassus) does it seem clear that there was no pelvic pain, nor tenderness of the tumour on touch. Thus, as a rule, primary cancer of the tube is a painful disease, and Miknoff's case demonstrates that tension of the tubal walls must be the usual source of pain.

The presence of a *swelling* was reported in fifty cases uncomplicated by any other kind of tumour, except in one of Peham and Chrobak's cases, where an exploratory incision was made on account of ascites, so that no solid tumour could be defined until the fluid was removed. In Fischel's case alone do we find a cancerous tube forming an abdominal tumour of considerable size.

Five cases have been reported of *fibroid tumour of the uterus complicating primary cancer of the tube* (Watkins 1, Quénu and Longuet 2, Bland-Sutton 2), and seven of complication of tubal cancer with *ovarian cyst* (Cullingworth, Knauer, Graefe, Dirner and Fonyó, Russell Andrews and Herman, Zangemeister, and Peham and Chrobak). In cases reported by Essex Wynter, Routier, Savor, and Zangemeister, the relation of the cyst to the tube and ovary was less clear, but the last observer detected cancer of both tubes, the left forming a tubo-ovarian cyst of which only the tubal segment was the seat of cancer.

A tubal cancer rarely forms a *movable tumour*; a notable exception is recorded where a tumour of the right tube, as big as an egg, lay in front of a retroverted uterus. Its pedicle was twisted (Stroganoff). I have observed a similar displacement in early tubal pregnancy.

In only four cases of cancer of the Fallopian tube is *ascites* recorded. Le Count's case is interesting; the ostium of the tube was patulous, so that the tumour was the malignant homologue of Spencer Wells's papilloma above described, just as Miknoff's cancer with vaginal discharge corresponded to Doléris's papilloma. Briggs, Danel, and Peham and Chrobak report cases of ascites. In the third there was small cystic degeneration, not malignant, of both ovaries; in the others cancer was disseminated widely. Close *adhesions* around the tumour are usual, and they perhaps account for the rarity of ascites.

Much stress has been laid on the frequency of a *history of pelvic inflammation*.[1] In about twenty out of fifty-six cases with fairly reliable clinical histories evidence of old inflammation was strong, and in nine more highly probable. On the other hand, in nearly as many of the remaining cases a history of inflammation is wanting. Witthauer, an opponent of the origin of cancer from inflammatory papilloma, justly looks on some histories of pelvic inflammation as unconnected with the subsequent cancerous changes in the tube, which in some cases may not have been involved in the inflammatory process. Again, as patients do not always relate past illnesses so clearly that their true nature can be defined, in many cases earlier salpingitis may have been overlooked. Cancer originating in an uninflamed tube is, of course, quite conceivable.

Pathology of the tumour, according to reported cases.—In all the sixty-two cases it was assumed that the new growth was a carcinoma. In most of them the malignancy was only too evident, and where it was not so clear the tumour may have been a papilloma. The next assumption is the primary nature of the tubal cancer, and it is highly probable that a mistake has been made in more than one case. The source of error indicated by Fabricius and Winter must be borne in mind. Turning to the appearance of the tumour itself, it is described in forty-seven cases out of sixty-two as "papillomatous," "papillary," or "villous"; in one as a cauliflower mass of adeno-carcinoma, and in one as a pure spheroidal-celled carcinoma. In five it appeared as a medullary or spongy mass, which would presumably indicate an advanced stage of disease, but in one of these cases (Quénu and Longuet) there was no recurrence over two years after the operation. In the cases recorded by Kaltenbach and Fabricius cancerous degeneration of papilloma seemed taken in the act. Friedenheim traced primary alveolar cancer to an accessory tube. Falk detected typical cancer in a dilated tube; seven months later, after the death of the patient, a sarcomatous mass was discovered in the endometrium; the cæcum was also the seat of malignant disease. In other cases the appearance of the tumour is not mentioned, the reporter merely noting that sections showed the appearances of cancer.

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[1] Osterloh reports how a supposed pyosalpinx, simulating abscess in the abdominal walls, was removed and malignant disease was detected a year later in the cicatrix; then the "pyosalpinx" was examined more closely, and found to be a cancerous tube (*Zentralbl. f. Gynäk.* 1895, p. 924, and 1896, p. 809).

Diagnosis.—The above analysis of so much experience shows that this disease is seldom detected at an early date. In the middle stage diagnosis is not so difficult. A watery, sanious discharge in a woman between forty-five and fifty-five, associated with a distinct and usually tender swelling in one lateral fornix, without clear evidence of uterine cancer or of a movable ovarian tumour, are indications of the existence of primary cancer of the Fallopian tube.

In cases of advanced cancer of the pelvic organs the primary seat is not always easy to define; but as a rule a cancerous ovary forms a big, mainly abdominal, tumour, with very definite attachments to the uterus. When the interior of one or both tubes is full of carcinomatous growths, and the ovaries, though infected, are small and sealed up in the pelvic cavity by free malignant deposit, the chances that the primary seat of disease lies in the tubal mucosa are high. If it be not in the ovaries, uterus, bladder, or rectum, the pelvic connective tissue must be borne in mind; but, judging by recent clinical research, this structure appears to be very rarely the seat of primary sarcoma, and never of a cancer. In Pollack's recently reported case there was a pair of big primary "cylindromas" of the parametrium, but the tubes were found intact. The above considerations are of importance in relation to diagnosis by exploratory incision.

With regard to *treatment* operation was undertaken in sixty-one more or less completely reported cases. In twelve, above noted, hysterectomy or ovariotomy was performed because there was a uterine or ovarian tumour as well. The majority of the other cases underwent exploratory abdominal or vaginal operations, and then the diseased tubes were detected and removed; the mortality amounts to three in about thirty-six cases[1] (Orthmann, sepsis; Dirner and Fonyó, sepsis; Warneck, death after second operation for intestinal obstruction in the third week—all three abdominal). As a full inspection of the adjacent parts is necessary, the abdominal operation is preferable to the vaginal; but removal of the tube is insufficient. On this account, in over a dozen cases the uterus was removed with the appendages, with only one death (Fabozzi), where the operation was incomplete, the fundus alone being amputated.

Four deaths in over sixty cases do not represent a high mortality, but after-results are, as might be expected, much less satisfactory. In order to observe the date of *recurrence*, about forty cases have been fairly followed up after operation. Over twenty cases lack after-histories of the slightest value. More than a quarter of all the patients were dead or dying between six months and one year after removal of the affected parts.

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[1] In certain instances (Pilliet, etc.) the reports are brief, and it is not clear that the patient recovered.

A few died earlier, but the disease in them was advanced at the date of operation. In the reports of many cases there is some confusion between the date of recurrence and the date of death from recurrence. Four instances of freedom from recurrence deserve to be remembered: the first, seven years (Veit); the second, three years (Dirner and Fonyó); the third and fourth, two years and two months (Russell Andrews and Herman, Quénu and Longuet).[1] Shorter histories of immunity are of little value. One of Zangemeister's cases died, at the end of three years, of perforating peritonitis caused by malignant infection of the cæcum; Brennecke's patient was living, but affected with cancer of the intestines three years after removal of both tubes. Pathologists must feel sceptical about the malignancy of the tubal tumour when immunity after operation extends over a couple of years. How cure can be expected when only the tube is removed (and then never entire) I myself cannot understand, and knowing how very ugly Spencer-Wells's innocent papilloma looked when I examined it in 1879, I cannot help suspecting that some of the tumours in the cases above mentioned must have been of the same kind.

Altogether the risks of operation are as trifling as the benefits are limited. Indeed, it seems strange that the immediate danger is proved by experience to be slight; and when we remember how different are the results of operation on old suppurating tubes, we must conclude that these cancers remain remarkably free from septic germs.

SARCOMA OF THE FALLOPIAN TUBE

Secondary sarcoma.—In primary sarcoma of the ovary, a well-recognised and not very rare disease, the tube is seldom implicated. I have examined enormous sarcomas of the ovary where the tube remained intact. On the other hand, in a few cases I have seen sarcomatous nodules scattered over the peritoneal covering of the tube. The new growth more frequently passes from the ovary to the omentum, and to the serous investment of the intestines, uterus, and abdominal walls.

Primary sarcoma.—Seven cases of this condition have been recorded by Senger of Breslau, Gottschalk, Janvrin, Professor Sänger, von Kahlden, von Franqué and Schäfer. Charles Dixon-Jones's (14) description of three cases of "myeloma" deserves study; they caused death by intraperitoneal hæmorrhage. The two most recent cases (von Franqué and Schäfer) showed mixed sarcoma and cancerous papilloma. Coe of New York doubts that the tubes in Senger's case, examined at a necropsy on a woman aged fifty-one, who had died of diabetes, were the seat of a new growth. The tubules, to which I have already referred, found in the substance of the growths, were considered by Coe to represent pseudo-follicular salpingitis, the whole being an inflammatory product. But the secondary deposit in Dr. Senger's case indicates that the growth was sarcoma, and Professor Sänger considers that it was pathologically the same as his own case, a small, round-celled sarcoma. Von Kahlden's case, like Senger's, was detected at a necropsy. In Sänger's patient alone was watery discharge observed as a symptom. Primary sarcoma of the tube has certainly occurred, but it is too rare to allow us to be able to distinguish its symptoms or to determine its relation to tubal inflammation. For further information about sarcoma the reader is referred to Quénu and Longuet's and Peham's monographs, and to other works quoted above in the paragraphs on cancer.

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[1] A fifth case must be added, namely, the second reported by Zweifel, of which Zangemeister (67) has traced the after-history. The patient was alive and well eight years after the operation. Supravaginal hysterectomy was performed in this, the most satisfactory case in the history of tubal cancer.

Chorionepithelioma of the tube.—Tumours of this type are not unknown in the Fallopian tube (*vide* p. 388). Reports of no less than ten have been collected by Risel (54), and he adds another. The patient, aged 35, had not been pregnant for five years. For three months she suffered from irregular hæmorrhages with occasional sharp abdominal pains, and a tumour was detected occupying Douglas's pouch and the left fornix. It was removed and proved to be a chorionepithelioma of the left tube. Death occurred four months later, a large tumour having developed between the uterus and rectum, whilst deposits were found in the liver and lungs all histologically identical with the primary tumour. Risel adds to his report notes on five cases of vesicular mole in the Fallopian tube. These facts are interesting when we remember the relations of uterine pregnancy, vesicular mole, and deciduoma. ALBAN DORAN.

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A. D.

PELVIC INFLAMMATION

In dealing with so wide a subject as pelvic inflammation it is necessary at the outset to state the precise meaning which, so far as the present article is concerned, these words are intended to convey. The phrase, as here used, must be understood to include the two affections known as pelvic cellulitis and pelvic peritonitis. The inflammation of the several viscera contained in the female pelvis will be described in other parts of this work, and will only be referred to here in so far as they are concerned in the pathological processes that lead to the two diseases just named.

Several writers of distinction, amongst whom Virchow and Matthews Duncan may be specially mentioned, have named the inflammations now about to be considered "perimetritis" and "parametritis"; the former term was used by them to signify inflammation of the pelvic peritoneum, the latter to signify inflammation of the pelvic connective tissue. These terms have not been adopted in the following article for several reasons, of which only two or three need be given. Firstly, the words perimetritis and parametritis are so nearly alike that their use introduces an additional and quite unnecessary element of confusion into a subject that, for the beginner at any rate, is already sufficiently beset with difficulties; secondly, these terms imply a difference which does not really exist in the anatomical relations between the peritoneum and the uterus on the one hand, and the connective tissue and the uterus on the other. As a matter of fact, the pelvic connective tissue is in as close contact with the outer surface of the uterus (though of course with different parts of it) as is the pelvic peritoneum. It is inaccurate and misleading, therefore, to speak of an inflammation of the one tissue as being an inflammation around the uterus (peri-metritis), and an inflammation of the other as being an inflammation near it (para-metritis). Thirdly, the words perimetritis and parametritis describe, in terms of the uterus alone, affections which often involve all parts of the pelvis, and are not necessarily uterine even in their origin.

Until comparatively recent years the views generally held and taught with reference to pelvic inflammation were exceedingly vague and unsatisfactory—in many respects indeed erroneous. Clinical observation was so seldom brought to the test of the operating theatre and the post-mortem room that certain erroneous inferences drawn from facts observed at the bedside remained year after year uncorrected by actual inspection and dissection, and were thus accepted as articles of current professional belief. Almost every attack of pelvic inflammation was believed to be a cellulitis; and if, on vaginal examination, a hard, irregular, fixed mass could be felt on one or both sides of the uterus, the diagnosis of cellulitis was held to be established beyond cavil. It is true that many years ago, in France, Aran and Bernutz combated this view, and the latter proved by a large mass of post-mortem evidence the true nature of the majority of these swellings; but the influence of their writings upon the current belief and teaching was for many years inappreciable. It was not, indeed, until the practice of abdominal surgery became extended, and opportunities of comparing the physical signs with the actual conditions became thereby more frequent, that the truth of their main contention began to be generally recognised and accepted. The knowledge thus gained from abdominal surgery on the one hand, and the advances made in our knowledge of the anatomy of the female pelvis—especially by the study of frozen sections—on the other, have completely revolutionised our views of pelvic inflammation; whilst the light shed by modern research on the inflammatory process itself has tended still further in the same direction. Any one who now undertakes to give an account of pelvic inflammation must consider it from an entirely new standpoint, alike as regards its etiology, its pathology, its diagnosis, and its treatment. It is not pretended that our knowledge is as yet sufficiently complete to make it possible to deal with any of these points in an entirely satisfactory manner. All that can be done at present is to indicate the lines on which the subject must henceforth be studied, and to eliminate from the description all that modern investigation has shown to be ill-founded or erroneous.

After these introductory remarks on the general subject of pelvic inflammation we may proceed to consider its two great varieties.

PELVIC CELLULITIS

SYNONYMS—*Parametritis; Peri-uterine phlegmon*

Definition.—Pelvic cellulitis is an inflammation of the pelvic connective tissue. Such an inflammation may be primary or secondary; that is, it may originate in the connective tissue itself, or it may originate in one of the neighbouring structures and reach the connective tissue by extension. The primary form, which is the one here considered, is an acute infective disease; indeed, it differs in no respect from acute inflammation of the connective tissue in any other part of the body. Chronic pelvic cellulitis is always a secondary affection, complicating inflammation of some other part; it is never the sequel of an acute cellulitis.

Anatomy.—The pelvic connective tissue is not a special structure, but is a "portion of a wide system of mesoblastic connective tissue which surrounds the great vessels of the trunk, accompanying their branches from origin to termination, and extending mainly in the form of perivascular sheaths, to all parts of the body" (Anderson and Makins). In the pelvis the connective tissue is found partly in the form of a loose areolar network, and partly in the more condensed form of fasciæ. It surrounds all the blood-vessels, nerves, and lymphatics, as well as the ureters; and passes, as investing sheaths, to certain of these outside the limits of the pelvic cavity. Below, it is shut off from the perineum and ischio-rectal fossæ by the pelvic fascia. "This strong aponeurosis is attached to the pelvic wall between the pubic bones and bodies of the ischia, along that thickening of the obturator fascia known as the white line. From this it passes as a continuous sheet over the levator ani and coccygeus muscles to the vagina in front, and the rectum and coccyx behind. Behind the pubic symphysis it is closely blended with the vaginal orifice under the name of the triangular ligament. All inflammatory exudation connected with the female genitals above the vulva takes place above this strong fascia" (Keiller). The cellular area of the pelvis, thus bounded below, has for its upper boundary the peritoneum. Here, however, its limitation is less strict, as it is continuous with the subserous connective tissue of the parietal peritoneum of the abdominal cavity. Turning now to the distribution of the pelvic connective tissue we find that, except perhaps over the fundus uteri, it forms a layer under the entire pelvic peritoneum, parietal and visceral. The so-called "ligaments" of the uterus contain a greater or less quantity of it between the peritoneal folds of which they are composed; and in certain special situations it may be said to be abundant; for example, around the supravaginal portion of the cervix uteri, along the base of the broad ligaments, and between the bladder and the symphysis pubis. In the last-named situation it contains in its meshes a varying quantity of fat.

The office of the connective tissue, in the pelvis as elsewhere, is simply "to connect and support the other tissues, performing thus a passive mechanical function" (Schäfer).

The layer of the connective tissue intervening between the vaginal roof and the peritoneum does not ordinarily measure more than about one-third of an inch in thickness; but the study of frozen sections has shown us that in pregnancy its thickness is greatly increased. The broad ligaments are gradually drawn upwards during the growth and development of the pregnant uterus, until, at the end of pregnancy, they lie in the iliac fossæ, entirely above the brim of the pelvis; and no peritoneum is found dipping into the lateral parts of the pelvis. The space thus vacated by the broad ligaments and the reflections of peritoneum behind and in front of them is filled up by connective tissue, so that the quantity of connective tissue in the pelvis is in the later months of pregnancy enormously increased. This fact, it need scarcely be said, has a most important clinical bearing.

Etiology.—Primary pelvic cellulitis is always a result of septic infection. Its most common source is the absorption of septic matter through the lacerations of the cervix uteri and of the upper part of the vagina which occur during labour. Injury to the vagina results from the use of obstetric instruments, especially the forceps, much more frequently than is generally supposed. On many occasions, when examining cases of puerperal pelvic cellulitis seen in consultation, I have discovered wounds of the vagina which had evidently been caused by the projecting edge of one of the blades of the forceps, and which had been entirely unsuspected by the medical practitioner in attendance. Such wounds, if they remain aseptic, readily heal; but it often happens that septic matter finds its way into them, and then pelvic cellulitis results. In rare cases cellulitis may commence in the inner portion of the broad ligament immediately outside the uterus (where the connective tissue of the broad ligament is thickest) from direct infection through the tissues of the uterine wall. Polk and Lewers have each described a case of this kind verified by post-mortem examination. Other occasions of infection are the various surgical manipulations practised on the vagina and cervix. Before the necessity of aseptic precautions was understood and generally acted upon, the most trifling surgical proceedings in these parts were apt to be followed by an attack of cellulitis. Cases thus produced are now happily rare. Septic infection following abortion seldom gives rise to primary pelvic cellulitis, for the simple reason that the cervix uteri and vagina are not exposed to injury in the same degree; the cervix is not so much in danger of being unduly stretched during the passage of the ovum, nor is the vagina so liable to be wounded by instruments.

Inasmuch as lacerations of the cervix and upper part of the vagina (the parts around which the connective tissue is found in greatest abundance) are the injuries most likely to be followed by cellulitis, it follows that any surgical operation by which the integrity of these tissues is endangered, such as the removal of large uterine polypi, may, as in the process of parturition, open the way for cellulitic infection. It is obvious that special danger is incurred if, at the time of their expulsion or removal, the polypi are undergoing necrosis.

In connection with the etiology of cellulitis, it must be remembered that whenever the connective tissue has been subjected to bruising, as in parturition and the expulsion or removal of large polypi, its power of resistance to the infective process has been thereby diminished; in other words, its susceptibility to infection has been increased.

The lymphatics are the channels by which the poison is conveyed to the connective tissue. Hence there is always a certain amount of lymphangitis associated with cellulitis. It is highly probable that the lymphatic glands also are generally implicated, as well as the lymphatic vessels. But as both the lumbar glands, which receive the lymphatics from the broad ligaments and the body of the uterus, and the hypogastric or pelvic glands, which receive the lymphatics from the cervix uteri and upper portion of the vagina, are out of reach of the examining finger, we are without direct clinical evidence of glandular enlargement. We know, however, that in acute cellulitis in other regions of the body, where the lymphatic glands are in situations in which they can be examined by the sense of touch, glandular enlargement is invariably found, and glandular suppuration is by no means uncommon. Hence we are justified by analogy in concluding that in pelvic cellulitis a similar condition of things usually obtains. Moreover, cases of cellulitic abscess in the pelvis not unfrequently occur in which the situation of the abscess makes it highly probable that the hypogastric glands are involved in the suppuration.

Frequency.—It is not possible at present to give any exact statement as to the frequency of pelvic cellulitis. It is certain, however, that, compared with pelvic peritonitis, it is a rare affection.

Pathological anatomy.—Pelvic cellulitis occurs with or without the formation of pus. In the latter case, as in cellulitis elsewhere, there is an exudation of coagulable lymph, with œdema, into the tissue of the infected area, which at first produces increase in bulk without manifest alteration of consistence. Very soon, however, the inflamed tissue becomes stiff and indurated, and at a later stage the hardness is often so marked as to be not inappropriately compared with cartilage. As the patient recovers, the inflammatory exudation gradually undergoes absorption and eventually it disappears altogether. When suppuration occurs the result is a true pelvic abscess. Usually there is a single large abscess cavity, but occasionally several abscesses are found in contiguous portions of the cellular area.

Symptoms.—Pelvic cellulitis is often ushered in by a rigor. This usually occurs, both in puerperal and non-puerperal cases, on the second or third day after infection; but it may, and often does, take place later. It is the occurrence of this rigor or chill as the initial symptom that has given rise to the popular but erroneous notion that the disease may be the result of exposure to cold. Simultaneously with the rigor the temperature rises and the pulse becomes accelerated. Pain seldom occurs unless the inflammation extend to the neighbouring peritoneum. This absence of pain throws difficulties in the way of early diagnosis. Both patients and medical practitioners are so accustomed to look upon pain as an essential condition of all local inflammations, that when their usual guide fails them the local inflammation is apt to escape notice, and the accompanying pyrexia to remain unaccounted for, or to be accounted for in some other way. Hence the existence of pelvic cellulitis is often unsuspected until the patient leaves her bed and begins to move about, when she finds herself incapacitated and obliged to go back to bed. The physical signs having become by this time well marked a pelvic examination soon discloses the true state of affairs. In cases attended with suppuration, perhaps the most marked symptom is the progressive emaciation; this is always associated with pallor and with a certain earthy sallowness of the skin which is highly characteristic. The skin over the body generally is harsh and dry, and covered with branny scales the result of fine desquamation. The patient, in severe cases, looks extremely ill. All desire for food is lost. The bowels are ordinarily constipated, though occasionally there is diarrhœa. There is often marked mental depression, with an irritability of disposition that may be quite foreign to the patient's true character. It is most interesting to observe how quickly the symptoms are ameliorated when the pus is evacuated and tension relieved. Within a few hours the patient's aspect will have undergone an entire change, and her irritability and despondency will have disappeared. If the exudation extend to the connective tissue in the neighbourhood of the psoas and iliacus muscles, and still more, if it involve the connective tissue elements in the substance of these muscles, the patient (in order to relax the muscles) lies with the thigh of the affected side bent upon the trunk and the leg drawn up.

The general symptoms are those of a subacute form of septicæmia; the local symptoms are often so few and indefinite that, as has been already pointed out, the existence of an acute inflammatory process within the pelvis may remain unsuspected until the patient begins to try to move about, *i.e.* until towards the end of the second week after infection.

Physical signs.—In the early days of an attack of acute pelvic cellulitis physical examination gives us but little information. The vagina is hot and tender, and its vessels may be felt pulsating, and that is all. After the lapse of several days the physical signs are those of inflammatory exudation, at first brawny in consistence and afterwards densely hard, in the tissue of the affected area. When the poison has entered through a wound in the cervix, the cervix is found to have lost its normal mobility, and the supravaginal tissues on the affected side are found uniformly tender and more or less hard and unyielding. Owing to their swollen condition they cause a depression of the lateral fornix of the vagina on that side, sometimes completely obliterating it. It is seldom that both sides of the pelvis are equally affected; but it is by no means unusual to find the whole supravaginal portion of the cervix embedded in a thick, tender collar of indurated tissue, which more or less completely surrounds it. In the majority of cases the inflammation spreads laterally along the base of the broad ligament of the infected side, and then passes forward to the tissue beneath the reflection of peritoneum on the anterior abdominal wall. It is at this stage that an area of uniform hardness and resistance can be felt in the abdominal wall beneath the muscles. This hardness usually takes the form of a broad band, measuring one and a half to two inches or more in width, and lying along the upper border of the inner portion of Poupart's ligament. More rarely the area of hardness is confined to the suprapubic region, whence it may gradually extend upwards, even as far as the umbilicus. Sometimes the exudation spreads into the iliac fossa, interfering with the action of the psoas and iliacus, and leading the patient to keep the thigh flexed in order to relax these muscles. In some instances the inflammation passes backwards instead of forwards, producing an exudation in the tissue of one or both utero-sacral ligaments, in the tissue surrounding the rectum, and in that beneath the peritoneum lining the posterior pelvic wall. In these cases much information can be obtained from a rectal examination, when the rectum will be felt wholly or partially surrounded with a hard belt of exudation. As pelvic cellulitis is at least as common on the left side of the pelvis as on the right, such an implication of the tissue surrounding the rectum is by no means unusual. Meantime there is no swelling in the situation of Douglas's pouch unless the case be complicated with pelvic peritonitis. When the body of the uterus is the starting-point of the cellulitis, and the broad ligament itself the seat of the exudation, bimanual examination will reveal a hard, smooth, flattened, slightly movable tumour by the side of the uterus and inseparable from it, occasionally displacing it a little towards the sound side.[1]

When there is no suppuration the exudation becomes absorbed, and in uncomplicated cases the hardness gradually disappears, leaving no trace behind.

Pelvic abscess.—In a considerable number of cases of pelvic cellulitis the inflammation is attended with the formation of abscess. The situation of the abscess, and the position where it may be expected to point, depend, of course, upon the direction in which the inflammatory exudation has extended. Taking the most common case first,—that, namely, where the inflammation is seated in the tissue at the base of the broad ligament, and passes forward beneath the peritoneum as it is reflected on the anterior abdominal wall, forming an area of induration above Poupart's ligament,—the presence of suppuration is manifested by the occurrence of œdema in the skin over the indurated area, which pits on pressure; by the signs of deep-seated fluctuation, and by the eventual pointing of the abscess at a site usually a little above Poupart's ligament. This site can often be detected long before the pus has reached the surface, by passing the tip of the finger carefully over the indurated area, where it can be recognised as a soft depression in the midst of the surrounding hardness.

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[1] An exaggerated importance has been attached to lateral displacement of the uterus as a distinctive sign of pelvic cellulitis; it occurs but rarely, and is of little diagnostic value.

Of twenty-two cases of cellulitic abscess treated at St. Thomas's Hospital during the years 1889-93, the abscess pointed above Poupart's ligament in no fewer than eighteen. Whenever pelvic cellulitis extends in such a direction as to cause an induration in the abdominal wall—whether that induration be in front of the bladder (suprapubic), or above Poupart's ligament, or over the iliac fossa—it may reasonably be expected that, if an abscess be formed, it will point on the external surface of the body at the site of the induration. Unfortunately, pelvic cellulitis, as has already been stated, sometimes extends in a backward instead of in a forward direction, probably following the course of the lymphatics; if, under such circumstances, suppuration occur, the result is less satisfactory. An abscess is then formed beneath the peritoneum, covering the back of the pelvis, and, as the contents of such an abscess have no direct access to a free surface, relief is much longer delayed, and extensive burrowing is almost inevitable. Extension into the iliac fossa and the loin is more particularly apt to take place when the posterior pelvic wall is thus the seat of an abscess, the abscess pointing either at the iliac crest or above it. Sometimes the pus leaves the pelvis by the sciatic notch, and follows the course of the sciatic and gluteal vessels; in other instances it makes its appearance in Scarpa's triangle, having found its way by the side of the femoral vessels. By whatever route the pus makes its way out of the pelvis it does so by following the track, not of nerves or of tendons, but of the blood-vessels, and other parts, such as the ureter, which, like the blood-vessels, are accompanied by a prolongation of the connective tissue as they enter or leave the pelvis. It is sometimes stated that a pelvic abscess may follow the course of the psoas muscle; but when matter burrows along the psoas it comes, not from a cellulitic abscess, but from dead bone.

The statement, so commonly made, that cellulitic abscesses frequently burst into the rectum, the vagina, and the bladder, appears to rest on very slender foundation. Many of the cases quoted in its support belong to a time when little was known of the pathology of pelvic inflammation, and on reading them in the light of our present knowledge it is easy to see that at least a considerable number of the cases reported as cellulitic abscesses were really cases of intraperitoneal suppuration, originating in suppurative disease either of the Fallopian tubes or the ovaries. There is, however, no anatomical reason why cellulitic abscesses should not occasionally discharge themselves into the rectum, the vagina, or even the bladder; and some of the cases on record appear to be genuine examples of such an occurrence.

The usual time for an abscess to point is from the seventh to the twelfth week after delivery. The earliest period at which I have known pointing to occur is five weeks, the latest fourteen.

Diffuse pelvic suppuration.—In connection with this subject of abscess in the pelvic connective tissue there must be mentioned a peculiarly malignant form of pelvic inflammation, occurring for the most part in puerperal women, in which, in addition to other lesions significant of the virulence of the septic infection, there are found after death multiple abscesses in the connective tissue, many of them so small as easily to escape detection unless carefully looked for. This affection has all the characters of phlegmonous erysipelas. The tissues involved are œdematous and of a livid hue; suppurating thrombi are found in the veins, and the lymphatics are seen to be acutely inflamed. In a considerable proportion of the cases the ovaries are found to be in a state of suppuration, and there is usually evidence of extension of the inflammation to the pelvic peritoneum. Such cases are attended with all the symptoms of septicæmia in its most intense form and are rapidly fatal.

Diagnosis.—As pelvic cellulitis is usually unattended with pain, it has often made considerable progress before its presence is suspected. Puerperal women very naturally show a repugnance to vaginal examinations, owing to the tenderness of the external genitals and the presence of the lochia. When the puerperium runs a normal course this feeling is very properly respected, and the medical attendant is justified in abstaining from the infliction of the unnecessary pain and annoyance occasioned by digital examination. But it cannot be too strongly pointed out that the justification for this abstention ceases when symptoms of pyrexia supervene, and when it becomes evident that the ordinary course of recovery is being interrupted. A temporary elevation of temperature may, of course, occur from such causes as constipation and the influence of the emotions. As soon, however, as the medical attendant has satisfied himself that the symptoms are not of this transient nature, it becomes his duty, especially if the lochia be offensive, to make a thorough examination not only of the vagina, but of the interior of the uterus, which, during the first ten days after delivery, can be easily explored by the finger without having recourse to artificial dilatation. If the result of this examination be the discovery of a fragment of placental tissue or a decomposing blood-clot within the uterus he will, of course, remove it, and adopt suitable measures for cleansing and disinfecting the uterine cavity, with the almost certain prospect of thereby promptly relieving the symptoms. If not, he will have eliminated the most probable cause for the pyrexia and will, at the same time, have had an opportunity of detecting any swelling or other morbid condition in the tissues surrounding the uterus and vagina. Within a very few days of the onset of the attack the physical signs of pelvic cellulitis become sufficiently well marked to leave no room for doubt as to the diagnosis; and the discovery of a laceration of the cervix or of the vaginal wall will usually indicate the probable channel through which the infection gained an entrance. Frequently one of the earliest signs of cellulitis is an impaired mobility of the cervix, with tenderness and swelling on one side of it. A little later the inflamed tissue becomes stiff, and the stiffness quickly increases into a well-defined hardness. The inflammation may gradually extend all round the upper part of the cervix, or may spread outwards along the base of the broad ligament of the affected side, depressing the lateral fornix of the vagina, and sometimes obliterating it. At a later stage the induration will, in the majority of cases, extend to the subperitoneal connective tissue above Poupart's ligament, and become evident on external examination as a brawny, tender swelling in that region. The diagnosis of the presence of pus has already been described. When the direction taken by the cellulitis is towards the posterior part of the pelvis, an examination *per vaginam* of the posterior pelvic wall on both sides will usually reveal a diffused fulness and hardness on the affected side that are not to be found on the sound side; whilst a rectal examination will, owing to the infiltration of the tissues surrounding the middle portion of the rectum, render the diagnosis still more certain.

In the rarer case of the broad ligament proper being the part affected, the diagnosis is made by finding the mobility of the body of the uterus impaired by the presence of a more or less flattened mass of induration on one side of the body, and continuous with it. This mass is, when held between the two examining hands, capable of a certain amount of to and fro movement. It does not extend into the posterior pelvic fossa.

Except along the plane of tissue between the cervix uteri and the bladder, the cellular area of one side of the pelvis is more or less shut off from direct communication with that of the other side by a close attachment, in the middle line, of the visceral peritoneum to the bladder, fundus uteri, and rectum. Hence pelvic cellulitis is for the most part unilateral.

The differential diagnosis between pelvic cellulitis and pelvic peritonitis will be more conveniently considered when the physical signs of the latter affection have been described. The only other conditions likely to be confounded with pelvic cellulitis are hæmatoma of the broad ligament and fibromyoma of the uterus. In hæmatoma of the broad ligament there is an effusion of blood into the connective tissue of the ligament, which forms a slightly movable, somewhat flattened tumour by the side of the uterus, and continuous with it, simulating that rare variety of pelvic cellulitis which affects the broad ligament proper. The history of the case and the absence of symptoms of severe illness will, as a rule, serve sufficiently to distinguish a hæmatoma from an inflammatory condition. Hæmatoma occurs suddenly, either from the rupture of a pregnant tube into the connective tissue between the layers of the mesosalpinx, or from rupture of a varicose vein in the broad ligament. In either case the onset is usually marked by sudden pain and faintness, and usually also by an attack of vomiting. In the case of rupture of a pregnant tube one or more menstrual periods will probably have been missed, and attacks of pain will have occurred in the lower part of the abdomen, generally on one side, with slight irregular hæmorrhages from the uterus. The effect of a sudden outpouring of blood into the tissues of the broad ligament, so far as the temperature and pulse are concerned, is transient. Hence when the hæmatoma has existed for a few days the temperature and pulse become normal. The possibility, however, of the hæmatoma becoming infected and undergoing suppuration must be borne in mind. Should this occur the symptoms will be similar to those of pelvic abscess due to cellulitis.

In regard to fibromyoma of the uterus, it certainly seems extremely unlikely that this disease could ever be mistaken for a cellulitic exudation. Now and then, however, a case occurs in which a fibromyoma develops itself laterally between the layers of the broad ligament, fixing the uterus and forming a more or less hard tumour directly continuous with it. Should a localised peritonitis take place around such a tumour, or should such a tumour become inflamed or gangrenous, the diagnosis might be attended with considerable difficulty. A fibromyoma in the posterior wall of the uterus could scarcely give rise to misleading signs, large inflammatory exudations into the connective tissue behind the cervix uteri being extremely rare. Similarly, a fibromyoma in the anterior wall of the uterus is not likely to be mistaken for cellulitis, the signs of cellulitic exudation between the bladder and the upper part of the cervix being well marked and highly characteristic.

Prognosis.—Except in the diffuse variety of pelvic cellulitis, in which the cellulitis is only a part of a general septic process of the most acute and fatal type, the disease usually terminates in recovery. As soon as the fever subsides the exudation begins to undergo absorption, and under favourable circumstances it will have entirely disappeared in a few weeks. Unlike pelvic peritonitis, cellulitis, when uncomplicated by peritonitis, leaves no unpleasant results such as adhesions or displacements. The recovery is complete. An attack of pelvic cellulitis is therefore no bar to subsequent pregnancy.

If the fever do not subside in the course of five or six weeks suppuration has probably occurred. The duration and progress of the illness will then largely depend on the direction that the pus may take in its effort to reach the surface. In the large majority of cases the abscess will point above Poupart's ligament, where it can be opened easily and satisfactorily before much burrowing has occurred. These cases almost invariably do well. In the rarer cases, where suppuration occurs at the back of the pelvis, the pus is longer in reaching a surface, and is apt to burrow in different directions. Such cases often last a long time and are very trying. They are more apt, too, to be complicated by extensions to the peritoneum.

It is often stated that troublesome sinuses are not infrequent results of pelvic abscess. I have never myself yet seen a troublesome sinus result from opening a cellulitic abscess in the pelvis on the surface of the body; and I strongly suspect that the cases in which such sinuses have occurred have not been cases of cellulitic abscess, but of suppurating ovarian cyst or of other non-cellulitic form of pelvic suppuration. Similarly cellulitic abscesses are said to burst into the rectum, vagina, and bladder, and to form fistulæ in consequence. I believe this assertion to be, generally speaking, ill-founded. It must be a very rare occurrence for cellulitic abscesses to open into these organs; the abscesses that commonly open into them are the result of suppuration in the tubes or ovaries. It is easy to understand that such abscesses will not unfrequently be followed by fistulæ. But under ordinary circumstances a true pelvic abscess, that is, a cellulitic abscess, discharges its contents and disappears.

Treatment.—If the views here set forth concerning the uniformly septic origin of pelvic cellulitis be correct, the preventive treatment of the disease may be summed up in a very few words; it will consist in a strict regard to asepsis, or surgical cleanliness, in all midwifery cases and in all surgical manipulations of the female genital organs. If freedom from infection could be ensured to the parturient woman, pelvic cellulitis would almost entirely disappear; and if a similar freedom could be extended to every woman who is submitted to vaginal examination and manipulation, the disappearance of the disease as a primary affection would be complete.

It is very doubtful whether, when once an attack of pelvic cellulitis has been lighted up, it is possible to modify the course of the disease by any medication, internal or external. In this uncertainty it behoves us at least to be careful not to do our patients any harm. The remedies against the abuse of which I consider it specially desirable to utter a word of warning are opium and the antipyretics. Opium in one form or another is frequently given as a matter of routine. The result is a further disturbance of the already disturbed digestive functions, and an aggravation of one of the principal difficulties with which the physician has to contend, namely, constipation. Opium and morphia should be reserved for cases complicated with peritonitis, and therefore attended with pain, and should be given with the sole object of relieving pain. Similarly, antipyretics (including quinine when administered in large doses) should be reserved for the rare occasions when the temperature is so high as to constitute in itself a source of danger. When there is no special therapeutic indication, a simple saline mixture containing liquor ammoniæ acetatis or potassium citrate, or some acidulated vegetable tonic, will be the safest and most suitable medicine. The state of the bowels should receive the most careful attention. A regular course of aperient medicine at bedtime will almost always be required, and will often need the supplement of a soap and water enema in the morning. The patient's comfort will much depend on the care with which fæcal accumulations are avoided. The question of feeding is of equal importance. In the acuter stages a liquid diet is proper, but as soon as possible fish or fowl should be given, and a persistence of febrile temperature need be no bar to a meat diet if the patient can take it. The tendency to emaciation calls for generous feeding, and concentrated foods are only to be used when ordinary food cannot be taken.

Local applications to the lower part of the abdomen are only necessary when induration is to be felt in that situation, or when pain is present. Hot flannel fomentations afford most relief; it is well to alternate them with the application of a thick layer of dry cotton wool, kept in place, if necessary, by a flannel bandage. The application of glycerine and belladonna, at present much in vogue, is of very doubtful value. It is inferior to hot fomentations and poultices as a means of relieving pain.

The hot vaginal douche, administered at a temperature of 110° to 115° F., was highly extolled by Dr. Emmet of New York, who believed it to be exceedingly efficacious in promoting absorption of the inflammatory exudation. Chiefly owing to his persistent advocacy, it has become more popular than any other form of local application. Though its remedial effect is very doubtful, it is often a source of comfort to the patient, and if administered gently can at any rate do no harm. Vaginal tampons of glycerine have for many years been in favour as an additional means of hastening the disappearance of inflammatory thickening. More recently, tampons soaked in a 15 per cent or 20 per cent solution of ichthyol in glycerine have been recommended for the same purpose. The remedial value of these applications is probably very slight.

When matter forms, the case is to be dealt with on recognised surgical principles; the abscess should be opened as soon as fluctuation is detected, or there is the faintest indication of pointing. In ordinary cases the drainage tube is required for a very few days only. In the great majority of cases the incision will be made externally. In this form of pelvic suppuration abdominal section is, in my experience, entirely uncalled for. Should the abscess point in the vagina, it must of course be opened there. Most, however, of the fluctuating swellings felt through the vaginal roof are not cellulitic abscesses, but belong to quite a different category.

Before concluding the subject of treatment I desire to call attention to the need, in those cases in which the patient lies day after day with the knee and thigh flexed, of guarding against permanent contraction of the knee-joint. This distressing result may generally be avoided by instructing the nurse to straighten the knee (by raising the heel and letting it rest on her hand) for a few minutes twice a day.

CHRONIC PELVIC CELLULITIS

Chronic pelvic cellulitis does not exist as an independent affection, or as a sequel to the acute disease above described; but it occurs occasionally as a secondary result of purulent salpingitis or other intrapelvic suppurative inflammation. It only involves the parts immediately contiguous to the inflamed structures, and never gives rise to the broad band of induration in the lower part of the anterior wall of the abdomen so common in the primary affection.

The induration to which it does give rise introduces, of course, for the time being, an element of obscurity into the diagnosis of deep-seated inflammatory lesions in the pelvis; but it generally subsides under the influence of rest, thus at the same time establishing its true nature, and removing the difficulty interposed in the way of a satisfactory bimanual examination.

This variety of pelvic cellulitis is seldom or never attended with cellulitic abscess; it is characterised chiefly by œdema and small-celled infiltration of the connective tissue concerned.

PELVIC PERITONITIS

SYNONYMS—*Perimetritis, perisalpingitis, perioöphoritis.*

Definition and nature.—Pelvic peritonitis is an inflammation of that portion of the peritoneum which is situated within the pelvis. It is a much more common affection than pelvic cellulitis, and is perhaps met with more frequently than any other inflammatory disease in the pelvis. In the vast majority of cases (if not indeed in all) it is an infective process, due either to the presence of pathogenic micro-organisms or to their chemical products.[1] Its action may, nevertheless, be regarded as in the main beneficial. Not only is it, in itself, an effort on the part of the organism to resist and do battle with the invading foe, but, by erecting barriers around the diseased area, it tends to narrow and confine the field of infection, and thus to shield the neighbouring structures from damage. "The purpose of peritonitis," says Treves, "is towards the saving of life, and not towards the destruction of it." This purpose, he goes on to add, is not always fulfilled. The poison may be too virulent, or may be present in too great quantity for the inflammatory process to cope with it successfully; or again the inflammatory process itself may be excessive, and, like most agencies that are powerful for good, it may prove itself powerful also for harm.

Etiology.—Pelvic peritonitis probably never occurs otherwise than as a result or complication of some pre-existing disease within the pelvis. Not unfrequently, however, it is the first indication of the presence of such disease; for the symptoms of peritonitis are for the most part acute and of a character to compel attention, whereas those of the original disease are often so slight as to be scarcely noticeable. Hence it happens that, in many cases, until an operation or an autopsy discloses the disease which was its starting-point, all we can say with certainty is that pelvic peritonitis is present. Under such circumstances it is not surprising that pelvic peritonitis was for a long time, and by some persons is still, regarded as being, occasionally at least, a primary idiopathic inflammation, the result of such simple causes as injury, exposure to cold, or the sudden arrest of menstruation.

As our knowledge advances it is becoming more and more doubtful whether this is ever the case. It is true that instances occur in which no pre-existing disease is discovered; but the number of such cases is diminishing so rapidly that the probability of their being merely due to imperfections in our knowledge and in our powers of observation is very great.

Salpingitis and its complications.—In the vast majority of cases pelvic peritonitis in woman is the result of inflammation of the Fallopian tube.

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[1] For an account of the most recent researches on this subject see *The Bacteriology of Peritonitis*, by L. S. Dudgeon and P. W. G. Sargent. 8vo. 243 pp. Lond., Constable, 1905.

Other causes will be pointed out presently; this, being much the most common one, claims our first and chief attention.

The mucous membrane lining the Fallopian tube is, at the abdominal end of the tube, continuous with the peritoneum; whilst at the inner or uterine end of the tube it is continuous with the mucous membrane lining the uterine cavity. Thus there is direct communication between the lower part of the genital tract and the peritoneum. Owing to the continuity of its lining membrane with that of the uterus and vagina, the Fallopian tube is exposed to constant risk of infection, and the tendency of acute infective endometritis, whether septic, gonorrhœal, or tuberculous, is to spread to and involve the tube. From the mere fact of the direct continuity of the structures concerned, the extension of the infection to the peritoneum is rendered almost inevitable; but the risk is still further increased by the peculiar anatomical position of the Fallopian tube in the human subject. No other mucous canal in the body is similarly situated. When, for example, the mucous membrane lining the uterus is inflamed, the patency of the cervical canal provides a natural outlet for the morbid secretions. In the Fallopian tube there is no such natural outlet. The uterine end of the tube, under normal circumstances, has a lumen only just large enough to admit a fine bristle. It will therefore be readily understood that a very slight amount of swelling of the mucous membrane, such as is probably inseparable from the mildest inflammatory attack, may block this end completely. Hence, as an outlet for inflammatory secretions, the uterine orifice may be regarded as practically non-existent. If there is, therefore, any outlet for them at all it is into the peritoneal cavity. It is this absence of a suitable outlet for the morbid secretions of the tube, and the continuity of the lining membrane of the tube with the peritoneum, that together give to the inflammatory affections of the tube such an exceptional importance, and make pelvic peritonitis so constant a sequel of salpingitis.

There are other ways, besides direct extension and the escape of inflammatory products, in which pelvic peritonitis may result from inflammation of the Fallopian tube. It is by no means an uncommon result of the inflammatory process for the abdominal end of the tube to become sealed by adhesions, or by inflammatory changes in the fimbriæ (*vide* p. 483). The morbid secretions are then retained within the tube, which thus becomes a centre around which the inflammatory process spreads through the wall of the tube to the neighbouring tissues, and chiefly to the peritoneum. Even if this extension do not immediately occur, the diseased tube is constantly liable to fresh inflammatory attacks from slight causes, and these may at any time extend to the peritoneum. If the pent-up secretion consist of pus, as is frequently the case, not only is the liability to recurrent attacks of pelvic peritonitis more marked than when the accumulation is merely serous or muco-purulent, but there is the added danger of ulceration of the tube wall with the possibility of the pus escaping into the peritoneum by perforation.

It has already been stated that the infective inflammatory process may originate either in sepsis, gonorrhœa, or tubercle. So far as is at present known this list exhausts the possible sources of infection. The name "catarrhal" is given to mild forms of endometritis and salpingitis, which are supposed by some authorities to occur independently of infection, but there is an ever-increasing amount of evidence tending to sustain the view that even these are the result of slight degrees of infection. Acute *septic* inflammation of the genital tract is met with after labour, after abortion, or after any operation or manipulation that involves the introduction into the vagina either of the fingers, or of any instrument, appliance, or remedial agent. In the great majority of cases in which the patient has not been exposed to the risk of septic infection in one or other of these ways, and in some cases in which the patient has been so exposed, the inflammatory process is the result of *gonorrhœal* infection. The changes induced in the Fallopian tubes by each of these sources of infection are described in detail elsewhere (see article on "Diseases of the Fallopian Tubes," p. 476). It has been stated, though the statement can scarcely be said to have been as yet generally accepted, that in the case of gonorrhœa the poison may, and in exceptional cases does, spread from the lower part of the genital tract to the pelvic peritoneum by way of the lymphatics (Wertheim). But there can be little doubt that the ordinary mode of dissemination in the case both of septic and gonorrhœal infection is along the mucous membrane. With regard to the third source of infection, namely, *tubercle*, the infection may reach the Fallopian tubes, and through them the peritoneum, either from areas of tuberculosis already existing in the patient by way of the blood, or from other organs, as in perforation of tubercular ulcers of adjacent intestine. But genital tuberculosis is occasionally found without any trace of tubercle being discoverable elsewhere in the body. In some of these cases it is probable that the infection has been conveyed by the blood without any demonstrable lesion having been produced by the tubercle bacilli at the portal of entrance to the body, just as in some cases of bone tuberculosis. In other cases it has been supposed, though it has not yet been definitely proved, that the infection has reached the genital organs directly from without, *e.g.* by the introduction of tubercle bacilli into the vagina by the examining finger, by the use of foul syringes or instruments, and more particularly by coïtus.

Sometimes the inflamed Fallopian tube infects the ovary, causing it to suppurate, and a fresh source of danger to the peritoneum is thus produced. The Fallopian tube must still be regarded as the starting-point; but instead of affecting the peritoneum directly, it does so in this instance indirectly, through the medium of the inflamed ovary. Under such circumstances the inflamed tube and ovary may both act as the sources of pelvic peritonitis; but, occasionally, the tube, after infecting the ovary, so far recovers as to be itself no longer a centre of fresh mischief, and an attack of peritonitis may then be due directly to the ovarian condition. Secondary infection of the ovary appears to be particularly apt to occur when the ovary is already the seat of cystic disease; and simple abscess of the ovary is much less common than suppuration in an ovarian cyst. The most usual mode of infection is through the cyst wall, at a spot where it has become adherent to the diseased tube. Occasionally, however, infection takes place by an ulcerative process, which allows the contents of the suppurating tube to escape suddenly by perforation into the interior of the cyst. This is the ordinary way in which a *tubo-ovarian abscess* is formed. Such a sudden extension of the suppurative process invariably provokes a fresh outburst of peritonitis, the attack being usually much more severe and dangerous than any that has preceded it. A still more alarming peritonitis is set up when the contents of a suppurating tube or of a suppurating ovary escape by ulceration into the peritoneal cavity. Fortunately it very seldom happens that such an escape takes place primarily into the general peritoneal cavity, so as to cause a diffuse suppurative peritonitis; the escape usually occurs into a space limited by adhesions, and results in an intraperitoneal abscess. An abscess so formed rapidly enlarges, and, if allowed to go on and the patient survive, eventually bursts, either into some neighbouring canal or viscus, or into the general peritoneal cavity, or on the surface of the body, according to its situation.

Although suppuration of an ovarian cyst is usually the result of infection from an inflamed Fallopian tube, it may occur independently of tubal disease. There is reason to believe, for example, that the infection is occasionally due to the contiguity of the rectum or some other portion of the intestine. This is especially likely to happen when the tissues have been injured by bruising, as in the process of parturition. Peritonitis may also result from twisting of the pedicle of an ovarian tumour. Experience shows that this accident—with consequent strangulation, intracystic hæmorrhage, and inflammation or necrosis, according to the degree of strangulation—is particularly apt to take place during parturition. Hence, whenever puerperal peritonitis arises, the possibility of its source in this accident should be borne in mind. That an ovarian tumour was not previously known to exist by no means excludes it from consideration.[1]

New growths, etc.—Apart from these complications, any new growth in the pelvis may, by its mere presence, set up peritonitis. The frequency of adhesions in ordinary cystic disease of the ovary is sufficient proof of this. But tumours vary considerably in their liability to excite the inflammatory process in the surrounding peritoneum. Thus it is exceptional to meet with peritonitis as a result of the presence of fibro-myomata of the uterus, even if very large, unless the tumours have undergone degenerative change; whilst papilloma of the ovary and tube, dermoids of the ovary, and malignant disease, are seldom found without evidence of more or less extensive peritonitis.

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[1] See a clinical lecture by the writer of this article "On Acute Twisting of the Pedicle in Cases of Unsuspected Ovarian Cyst," *Practitioner*, April 1900, pp. 371-385.

Severe septicæmia.—When septic infection of a severe type follows abortion, parturition, or surgical manipulations of the female genital organs, instead of limiting itself to an attack upon the mucous lining of the genital canal, it may spread along the lymphatics and the veins, and so give rise to a diffuse septic infection of the pelvis, involving amongst other tissues the peritoneum. In some cases a peritonitis so produced remains localised in the pelvis; but much more frequently the inflammation becomes general, and an acute general septic peritonitis is the result. Associated with this condition is usually found a diffuse pelvic suppuration of a peculiarly virulent form, a condition already described in the chapter on pelvic cellulitis.

Injury.—Both the teachings of bacteriology and clinical experience tend to show that injury alone will not cause peritonitis; and that it is only when the hand or instrument with which the injury is inflicted is surgically unclean that the inflammatory process is excited. In illustration of this we may contrast the rarity with which evil effects follow the most extensive injuries to the peritoneum inflicted during a difficult and severe case of abdominal section—say for the removal of a tumour in the broad ligament—or the accidental perforation of the unimpregnated uterus by the curette or uterine sound, with the terrible results that so frequently follow bungling attempts to produce criminal abortion. In fatal cases of the latter kind it is generally found that death has resulted from acute septic peritonitis, with a punctured wound of the uterus or adjacent tissues for its starting-point. It cannot be doubted that the question is entirely one of infection. The operator in such cases is almost invariably found to have been either very ignorant or very reckless,—in either case an extremely unlikely person to have adopted precautions against infection.

Allusion has already been made to another way in which injury may determine an attack of pelvic peritonitis. The shape and size of the normal female pelvis are such as to fit it for the passage of a normally sized child at the full term, but are not such as to enable it to accommodate anything beyond that. If, therefore, the pelvic space is encroached upon by a new growth, the size of which cannot be reduced or its position altered,—as, for example, by a small adherent multilocular ovarian tumour,—an obstacle is offered which either prevents parturition by the natural passages altogether, or renders it possible only at the expense of much bruising of the tumour. Should the latter event occur, the vitality, and, with it, the resisting power of the tumour are lowered, so that it falls an easy prey to pathogenic micro-organisms, whether they attack it from the uterus in front or the rectum in the rear. The occasional occurrence of puerperal peritonitis from suppurative inflammation of an incarcerated and contused ovarian cyst is to be explained in this way.

Pelvic cellulitis.—As pelvic cellulitis may be, and very frequently is, secondary to other forms of pelvic inflammation, so pelvic peritonitis may be the result of the spread of the inflammatory process from the adjacent connective tissue. This is especially apt to take place when the cellulitis is attended with suppuration, or when the portion of connective tissue chiefly involved is that which lies in the posterior part of the pelvis.

Pelvic hæmatocele.—The slighter hæmorrhages that occur within the pelvic peritoneum, and especially those which take place from the open fimbriated end of the Fallopian tube in the early stages of tubal pregnancy, usually result in the formation of a pelvic hæmatocele. The effused blood becomes shut off from the general peritoneal cavity by adhesive peritonitis, the surrounding viscera being thereby glued together, whilst the gaps between them are bridged over by the adventitious membrane formed from expanded adhesions and thickened by the firm coagulation of the outer layer of the blood itself. In this way the collection of blood becomes as it were encysted, the peritonitis thus serving both to limit the effusion and facilitate its ultimate absorption.

Disease of the appendix vermiformis.—Although it is not within the scope of this work to deal with diseases other than those which are peculiar to women, no account of the etiology of pelvic peritonitis would be satisfactory that did not include some reference to one, at least, of the causes that are common to both sexes, namely, disease of the appendix vermiformis. The normal position of the appendix is in the iliac fossa, above the brim of the pelvis; but instances are by no means uncommon in which the appendix is found lying within the pelvis, and it therefore becomes necessary when investigating a case of pelvic peritonitis, especially if the right side be the part chiefly affected, to bear in mind the possibility that the inflammation may be of intestinal origin. There is another way in which the diagnosis may be obscured. It has been shown, by the study of frozen sections, that towards the latter part of pregnancy the uterine appendages and broad ligaments are elevated completely out of the true pelvis; the consequence is that they are brought at that time into close contiguity with the cæcum and its appendix. If the appendix happens to become diseased, or, being already diseased, happens to set up an attack of peritonitis during this temporary displacement of parts, the pelvic peritoneum, broad ligament, and uterine appendages will almost certainly be involved, and the difficulty of diagnosis will be thereby greatly increased.

It is obvious that, within the limits of space at my disposal, it would be impossible to furnish anything like an exhaustive account of the etiology of pelvic peritonitis. The bacteriology, for example, has of necessity been entirely omitted.[1] I hope, however, that what has been said will convey some idea of the relative importance and comparative frequency of the principal causes of pelvic peritonitis, and will serve to emphasise the fact that pelvic peritonitis is no longer to be regarded as a disease in itself, but as an indication of the existence of some other disease, the nature of which it is our first duty at the bedside to discover.

Pathological anatomy.—The earliest change produced in the peri-

[1] See footnote on page 530.

toneum by inflammation is hyperæmia, with cloudy swelling of the endothelium. The membrane loses its normal, smooth, shining appearance, and becomes dull, dry, and slightly roughened. Plastic lymph is then poured out on the surface, and this leads to the rapid formation of adhesions between adjacent surfaces. The adhesions thus formed are the most characteristic feature of pelvic peritonitis. In cases where the inflammation is recurrent fresh adhesions take place during each attack, so that there are often in the same patient adhesions of different ages and varying density. In addition to the effusion of plastic lymph there is also effusion of serum. This serum tends to accumulate principally in the pouch of Douglas; but it also forms collections of fluid in different parts of the pelvis, wherever spaces intervene amongst the adhesions.[1] Thus are formed distinct and limited swellings which often simulate a true cyst.[2] One of the earliest results of the adhesive process is to roof in the contents of the pelvis at the level of the brim, and thus to shut off the cavity of the pelvis from that of the general peritoneum. When the quantity of plastic lymph thrown out is at all considerable, the lymph coagulates on the surface of the peritoneum, forming a distinct coating which can be peeled off like a membrane. Lymph coagula are also formed in the effused serum, and may be found either floating in the fluid or deposited on the surrounding surfaces. As its fluid portion becomes absorbed this coating of lymph stiffens the peritoneum, and, with the induration of the subjacent cellular tissue due to secondary cellulitis, contributes to produce the hardness which is one of the most striking of the physical signs of pelvic peritonitis in its later stages. The intra-peritoneal collections of serum generally become absorbed; but the adhesions continue for a long time, and many of them become permanent, with the result of producing more or less serious interference with the functions of the viscera involved. The evidences of inflammation are usually most strongly marked around the fimbriated end of the Fallopian tube, and diminish in intensity as the distance from that point increases. This is exactly what our knowledge of the etiology of pelvic peritonitis would lead us to expect. Inasmuch as the large majority of cases of pelvic peritonitis originate in salpingitis, it is not surprising that the firmest adhesions are met with at the mouth of the tube binding the fimbriæ to the part with which they happened at the time to be in contact. Where the peritonitis has not originated in salpingitis, but in some other morbid condition, such as a suppurating ovary or a diseased appendix vermiformis, the inflammation is most severe, and the adhesions are most dense, at the seat of origin wherever that may be.

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[1] Peritonitis attended with the effusion of serum has been quite unnecessarily described as a special variety of pelvic inflammation under the name of serous perimetritis.

[2] These swellings, which are only found in chronic cases, are bounded partly by the stretched broad ligament, adherent omentum, inflamed uterine appendages, etc. and partly by an adventitious membrane of extreme tenuity, consisting of a bridge or band of peritonitic adhesion much distended and thinned by the accumulation of fluid beneath it. They vary in size from that of a pea to that of a large orange, and may even exceed the latter in their dimensions. They are of no pathological importance, but often introduce difficulties of diagnosis. Mr. Targett, whose account of their pathology has been here adopted, has proposed for these tumours the name of perimetric cystoma (*Trans. Obst. Soc. London*, vol. xli. for 1899, p. 343). He exhibited to the Obstetrical Society of London an unusually large specimen in which the pseudo-cyst was subdivided into loculi by membranous septa.

It is usual for the Fallopian tube, when inflamed, to sink below its ordinary position, so that its abdominal end lies either upon the floor of the lateral fossa of the pelvis or in the pouch of Douglas. In other cases the tube, after embracing the ovary, becomes adherent by its fimbriated end either to the ovary itself or to a part of the posterior surface of the broad ligament internal to the ovary. In many instances the two tubes meet, and their distal ends become adherent to each other behind the supravaginal portion of the cervix uteri in the middle line. Less frequently the direction taken by the tube is different on the two sides: thus, one tube may be bent upon itself, with the usual horse-shoe curve, and terminate behind the broad ligament or upper part of the cervix uteri; whilst the other tube may run at first sharply forwards, then double upon itself, forming a loop or knuckle, and finally run outwards and slightly backwards to terminate against the lateral wall of the pelvis, and become adherent to it by its abdominal opening. In puerperal cases where, as has been already pointed out, the tube is lifted out of the pelvis by the development of the pregnant uterus, the mouth of the tube, and hence the chief area of the peritoneal inflammation, will be found at or near the pelvic brim close to the border of the psoas muscle.

Wherever the mouth of the tube may be, the ovary is almost invariably found implicated in the inflammatory process, and adherent over its entire surface—partly to the diseased tube, partly to the back of the broad ligament. In cases of old standing it is very common to find the ovary the seat of incipient cystic disease, and considerably enlarged. There is strong reason to believe, though there is as yet no definite proof, that this condition of the ovary is occasionally the result of changes induced by the surrounding peritonitis. Whenever the tube and ovary are bound to each other, the intervening portion of broad ligament—called the mesosalpinx—if it have not already been opened out and appropriated as part of the covering of the expanded tube, usually becomes creased, folded, and so intimately bound up with the adhesions as for all practical purposes to be effaced.

The mass formed by the agglutination of the tube, ovary, and broad ligament is usually found to have become adherent posteriorly to the peritoneum covering the posterior pelvic wall and the rectum. Sometimes one or more coils of intestine and a portion of the omentum intervene and become implicated in the entangled mass. The body of the uterus is sometimes involved in the adhesions and at other times is entirely free; its position remains normal unless the tube or ovary, or both, besides being adherent, are enlarged—the former by inflammatory, the latter by cystic changes—when the uterus is displaced to the opposite side and more or less rotated on its longitudinal axis. The roofing in of the pelvis is generally effected by adhesions of intestine and omentum to the horizontal rami of the pubes below, to each other, and to the matted contents of the pelvis posteriorly.

When the disease causing the peritonitis is purulent in character the peritonitis itself is also apt to be purulent; and, instead of accumulations of serum amongst the adhesions, collections of pus are formed—intraperitoneal abscesses. More rarely general suppurative peritonitis results; this only occurs in septic cases of exceptional virulence, or from the sudden bursting into the peritoneal cavity of collections of pus in the Fallopian tube or in the ovary. Intraperitoneal abscesses may be single or multiple, and may begin in several different ways. The most usual way is for the purulent contents of a suppurating Fallopian tube to be discharged from the abdominal end of the tube into Douglas's pouch or into a space bounded by adhesions. Sometimes both tubes discharge their contents into a common receptacle, and as the mouth of the tube is usually directed downwards and backwards, this receptacle is generally the pouch of Douglas. Here a tense fluctuating swelling is formed, easily felt through the depressed vaginal roof, and also through the anterior rectal wall which is bulged backwards so as to cause a more or less serious obstruction of that portion of the bowel. The discharge, however, may take place when the tube is not lying with its mouth in the usual direction, as, for example, when the salpingitis follows delivery, and the tube is situated at or above the pelvic brim as a result of the drawing up of the parts during the development of the pregnant uterus. The resulting abscess will then obviously be formed, not primarily in Douglas's pouch (though it may subsequently find its way there), but in a higher part of the pelvis, for example the iliac fossa, where it is in danger of being regarded as an extraperitoneal (cellulitic) abscess and treated accordingly.

Purulent salpingitis, however, not uncommonly results in the sealing up of the abdominal end of the tube; the pus is then confined within the closed tube, forming a pyosalpinx. Under these circumstances an intraperitoneal abscess may be formed either by infection of the peritoneum through the walls of the tube, or by the bursting of the pyosalpinx from ulceration commencing within, or by the spread of the infective process to the ovary, causing it to suppurate and to become in its turn a fresh focus of infection, and the seat of a fresh collection of pus liable at any moment to ulcerate and burst.

An intraperitoneal abscess, walled in by adherent viscera, may either run an acute course, or may remain for some time latent, giving few or no indications of its presence. Sooner or later, however, if the patient survive, one of two things must happen: either the abscess gradually dries up and disappears (which there is good reason to believe does occasionally occur in the case of small abscesses with non-virulent contents), or its walls undergo ulceration, and its contents make their escape either into the bowel—usually the rectum or the sigmoid flexure of the colon—or, more rarely, into the vagina, the bladder, or the general cavity of the peritoneum, or through some part of the abdominal wall. The common way of escape for the contents of an intraperitoneal abscess is undoubtedly by the bowel, as that for the contents of a cellulitic abscess is through the abdominal wall. Other routes than these may, in both cases, be regarded as exceptional.

Intraperitoneal abscesses in the pelvis differ from cellulitic abscesses in the same part in another very important respect. For whilst the latter as a rule quickly disappear when once they have found an outlet, the former are apt, either owing to their discharging their contents imperfectly, or to their being in communication with a mucous tract, *e.g.* the Fallopian tube, to result in troublesome sinuses which for months and even for years may remain a source of annoyance if not of serious ill-health.

Amongst the secondary changes that occur as a consequence of these inflammatory processes, there are one or two of such importance as to call for special mention. When the salpingitis is unilateral the peritonitis frequently extends to the other side of the pelvis, involving the healthy uterine appendages of that side in a mass of adhesions. Under such circumstances closure of the abdominal end of the healthy tube is apt to occur, and to be followed by the development of a hydrosalpinx in the manner described in detail by Mr. Doran in the article on "Diseases of the Fallopian Tubes." Hæmatosalpinx, as a complication of salpingitis, is much more rare. In the great majority of cases, effusions of blood within the tube and hæmatoceles of tubal origin are the consequences of tubal gestation. Now and then, however, they occur as incidents in the inflammatory processes above described quite independently of gestation.

Symptoms.—An attack of pelvic peritonitis is characterised by pain in the lower part of the abdomen, usually sudden in its onset, and for the first few hours severe in its character; by fever, as indicated by rise of temperature and increased rapidity of pulse; and very often by vomiting. There is usually more or less intestinal distension, sometimes general, sometimes localised. After the acute pain has subsided, movement is attended with suffering owing to the tenderness of the inflamed parts. The symptoms are usually sufficiently severe to oblige the patient to remain in bed for a time; and the length of time that the patient was confined to bed is the best rough test at our disposal of the severity of a past attack. Rigors are infrequent, except where the pelvic peritonitis is part of a diffuse septic inflammation, or where the symptoms are due to the intraperitoneal bursting of an abscess, as in the case of rupture of a pyosalpinx or a suppurating ovary. Constipation is generally met with; and pain preceding defæcation and during micturition occurs if the inflamed part be contiguous to the rectum in the one case and the bladder in the other.

In subacute and chronic cases pain in the back and inability to undergo physical exertion are the most common and may be the only symptoms. Menstruation usually becomes more profuse than natural, and is often accompanied with pain. Trifling causes, such as slight over-exertion or exposure to cold, readily provoke acute localised attacks of inflammation in patients with chronic pelvic peritonitis.

Such recurrent attacks are especially apt to occur when the chronic pelvic peritonitis is kept alive by the presence of pus, however small its quantity. Indeed, recurrent localised attacks of peritonitis afford a much more valuable guide to the diagnosis of pus in the pelvis than does the temperature. In twelve out of thirty of the writer's own operation cases in which suppuration was present, the temperature before operation was absolutely normal; and in only twelve out of the remaining eighteen was it distinctly and persistently febrile.

In severe cases, however, attended with suppuration, patients become ill and emaciated, and entirely incapacitated for work or for exertion of any kind. In the worst cases of all they become bedridden invalids. Between the two extremes, the one patient who is wholly confined to bed and the other who is scarcely conscious of anything wrong except during the occasional acute attacks that serve to betray the existence of some deep-seated lesion, there are, of course, all possible gradations. The amount of suffering endured by a patient with chronic inflammatory disease of the uterine appendages must always largely depend, not only on the extent and nature of the disease, but also upon the class of life to which she belongs and the demands made upon her activity.

During an acute attack of pelvic peritonitis the patient lies on her back, and is least uncomfortable when the knees are drawn up. There is extreme tenderness to the touch over the lower part of the abdomen, with rigidity of the abdominal wall over the affected parts. This rigidity is due to contraction of the muscles, and is not under the control of the patient's will. In exceptional cases a definite swelling can be detected on abdominal palpation. This is the case when the inflamed appendages happen to be situated above the pelvic brim; or when the attack is due to suppuration in an ovarian cyst of sufficiently large size to be reached on abdominal examination; or when there is an encysted exudation of serum or of pus in front of the uterus; or a sufficiently extensive exudation posteriorly to push the uterus forwards against the abdominal wall. As a rule, however, there is no swelling to be discovered, and any noticeable enlargement is merely that produced by local distension of the intestine with flatus. On vaginal examination the parts will, at this stage, be too sensitive to permit a satisfactory investigation of the lateral regions of the pelvis. If there be any depression of the vaginal roof it will most likely be central, and due to an encysted effusion of fluid, serous or purulent, in the pouch of Douglas, distending the sac, obliterating the posterior vaginal fornix, and displacing the uterus forwards. There may be tenderness and a sense of resistance on pressing the fingers upwards into one or both lateral fornices; but, unless there be a cystic ovary or other cause of unusual enlargement on the affected side, it will not be possible to map out any definite swelling in the posterior fossæ of the pelvis until the acute symptoms have subsided. When this event has occurred, a careful bimanual examination, conducted if possible whilst the patient is under the influence of an anæsthetic, will reveal in the posterior fossa of the pelvis on one or both sides of the uterus the presence of a fixed, irregular, tender swelling. This begins at the uterine cornu as a cylindrical body about equal in thickness to a lead pencil, and is capable of being rolled between the fingers; it runs outwards for a short distance, and then somewhat suddenly becomes thicker, curves upon itself, completely reversing its direction, and finally ends behind the cervix uteri in the pouch of Douglas. This swelling consists of the thickened Fallopian tube, adherent to the ovary, embracing it in the concavity of its curve, and surrounded on all sides by thickened and adherent peritoneum. The uterus is seldom pushed aside by this mass, and does not, as in the case of cellulitis of the broad ligament, appear to form a part of it. The uterus may, however, have been retroverted or retroflexed to begin with, when it will have become adherent in its abnormal position; or it may be pushed forwards as a whole by an effusion of serum or pus in the pouch of Douglas. Lateral displacement only occurs when there is exceptional enlargement either of the diseased tube or of the ovary. Under these circumstances, in addition to the pushing over of the uterus towards the opposite side, there may be some bulging of the swelling into the vagina, causing a depression of the lateral fornix,—a condition which, generally speaking, is much more characteristic of pelvic cellulitis than of pelvic peritonitis. When the lateral swelling in the latter affection is large enough to produce these displacements, the cause will, in the majority of cases, be found to be enlargement of the ovary from cystic disease,—a not very uncommon complication of inflammation of the uterine appendages.

The shape and consistence of the lateral swelling vary considerably in different cases, and even in the different stages of the same case. Sometimes the tube is soft and sausage-shaped; this is specially apt to be the case when the abdominal end is occluded and the tube is uniformly distended. Sometimes the distension affects the outer portion only, giving the mass the shape of a retort. In other cases the tube becomes irregularly distended from sacculation, or is thrown into complicated folds, forming sharp knuckles or prominences here and there as it bends upon itself, and presenting to the examining finger sausage-like convolutions with intervening grooves. The consistence of the mass depends partly upon the extent to which the walls of the tube have become thickened, and partly upon the amount of induration of the surrounding peritoneum. This latter is found to be most marked when the examination is made soon after an acute attack. As the patient recovers from the immediate effects of such an attack the hardness of the peritoneum gradually diminishes, and the outlines of the adherent appendages become more easily defined. In cases attended with suppuration or complicated with effusions of serum or pus amongst the peritoneal adhesions, the swelling is rendered still more irregular in shape and unequal in consistence. In some parts it may be possible to obtain clear evidence of fluctuation.

Diagnosis.—The only conditions likely to be mistaken for pelvic peritonitis are pelvic cellulitis and pelvic hæmatocele.

Pelvic cellulitis.—Some help in the diagnosis from cellulitis may be obtained from the etiology of the two affections. Pelvic cellulitis is, to begin with, a much rarer disease than pelvic peritonitis: its origin is exclusively septic, never, so far as is at present known, either gonorrhœal or tuberculous; it is essentially a disease of the puerperium, due to absorption of septic matter through wounds of the cervix uteri and vagina occasioned during the process of parturition. Over-stretching and laceration of the cervix being likely to occur only when the child is of full size, it is rare to find pelvic cellulitis following abortion and premature labour. In the cases where pelvic inflammation is the result of the absorption of septic matter during surgical manipulations, it will be found that it only takes the form of cellulitis where the manipulations have involved the integrity of the cervical tissues. Where the manipulations have been intra-uterine and unattended with injury to the cervix, the poison is absorbed, not by the connective tissue, but by the endometrium, the resulting inflammation extending along the mucous membrane of the Fallopian tube to the peritoneum.

It is generally held, and with truth, that the presence of acute pain points to the pelvic inflammation being peritoneal. Cellulitis, when uncomplicated, is a disease unattended with pain, or at any rate with severe pain. The sudden onset, then, of acute pain in an attack of pelvic inflammation is an indication that the inflammation has reached the peritoneum. After the acute stage has passed, however, the pain of pelvic peritonitis is only felt in standing or walking, though the tenderness remains, and is apparent on vaginal examination and during coitus.

It must, nevertheless, be remembered that pain in the pelvis, as elsewhere, is a most misleading symptom, and is seldom as severe in cases of actual disease as it is in many neurotic conditions in which there is no obvious lesion, inflammatory or other.

In both cellulitis and peritonitis there may be, and generally is, a swelling in the lateral regions of the pelvis; but whereas in primary, uncomplicated cellulitis the swelling is usually unilateral, smooth, uniform, and of stony hardness, depressing the vaginal roof and giving, on bimanual examination, no impression of any distinct swelling, irregular or otherwise, in the posterior pelvic fossa, in peritonitis it is more often bilateral than unilateral, and, instead of being smooth and of uniform consistence, and conveying the impression of being due to an exudation in the tissues immediately subjacent to the vaginal wall, it is irregular in outline and unequal in consistence, and is ascertained on bimanual examination to be situated in the fossa behind the broad ligament, with a certain thickness of normal tissue intervening between it and the internal examining finger. Another point of distinction is that in cellulitis the cervix uteri is apt to be surrounded by a hard, thick collar, in which it is immovably set; whilst in peritonitis there is no such girdle of indurated tissue, and the impairment of the mobility of the cervix is never so complete. Further, in cellulitis there is no inflammatory effusion or any kind of swelling in Douglas's pouch; whereas in peritonitis there is almost always either a certain amount of distension from inflammatory effusion (serous or purulent), or the pouch is felt to be occupied by a hard, irregular, fixed swelling, adherent to the supravaginal portion of the cervix uteri, and continuous with the fixed irregular mass situated in one or both lateral fossæ.

A similar difference exists in the conditions found on rectal examination. In cellulitis the rectum will often be felt to be surrounded, wholly or partially, by a belt of exudation of stony hardness, fixing the coats of the bowel at that part and narrowing the calibre of the canal. In peritonitis, on the other hand, any effusion within reach from the rectum will be in Douglas's pouch; it will be less hard, it will not affect the mobility of the coats of the bowel to the same extent, and, though it may press on the bowel in front, it will not encroach upon it laterally.

Such are some of the distinctive differences between the physical signs of primary pelvic cellulitis and pelvic peritonitis (of tubal origin) in the female pelvis. But pelvic cellulitis may be, and often is, secondary to an acute pelvic peritonitis, and then the physical signs of both are present, masking each other for a time, and rendering an accurate diagnosis difficult and perhaps impossible, until, under the influence of time and rest, the secondary cellulitic exudation has had time to become absorbed, permitting the irregular outline of the mass formed by the matted uterine appendages to be distinctly made out.

When the broad ligament itself is the seat of a cellulitic exudation, bimanual examination will reveal a hard, smooth, flattened tumour by the side of and continuous with the uterus, and sometimes displacing it slightly to the opposite side. This tumour can be moved to and fro within certain narrow limits. The swelling caused by the inflamed and adherent appendages in pelvic peritonitis is, on the contrary, of irregular contour, and is not continuous with the uterus, but on a plane behind it, and is quite fixed.

When the cellulitic exudation has reached the subperitoneal connective tissue of the anterior abdominal wall, it gives rise to a smooth, hard swelling in the deeper layers of the wall itself, either immediately above Poupart's ligament, or, more rarely, in the suprapubic region. This swelling has a well-defined upper boundary and is quite characteristic, there being nothing in the least like it in pelvic peritonitis.

In non-suppurative cellulitis the exudation becomes entirely absorbed, and the hardness disappears without leaving any trace, except where the exudation is in the substance of the broad ligament, when there may be some contraction with more or less dragging over of the uterus to the affected side. In favourable cases of peritonitis the hardness and thickening become much less marked; but the viscera once adherent are apt to remain so for an indefinite time, and there is generally to be felt a soft, irregular mass in the posterior part of the pelvis for the remainder of the patient's life, with some amount of uterine fixation and possibly of displacement.

Finally, suppuration in pelvic cellulitis generally takes the form of an abscess pointing on the surface of the abdominal wall a little above Poupart's ligament, and quickly disappearing when once it has found an outlet; whereas in pelvic peritonitis, if suppuration exist, it is either in the Fallopian tube (pyosalpinx), or in the ovary, or amongst the peritoneal adhesions (intraperitoneal abscess); its favourite outlet is into the large bowel or some other internal part, and it is apt to lead to the establishment of troublesome sinuses.

Pelvic hæmatocele.—The diagnosis of an effusion of blood in the pouch of Douglas from effusions of serum or pus depends largely upon the clinical history of the case, and upon the transient character of the febrile disturbance in pelvic hæmatocele (*vide* p. 588). As pelvic hæmatocele, in the vast majority of cases, is a complication of tubal pregnancy,[1] there will usually be a history of one or two menstrual periods having been passed, and of a sudden attack of pain, accompanied with nausea or vomiting and an alarming feeling of faintness. The patient will have a blanched appearance, the pallor being greater than the slight uterine hæmorrhage usually present is sufficient to account for. The effusion, at first distinctly fluid, soon acquires a doughy consistence from partial clotting; and, later, becomes diminished in bulk and harder, as the peripheral portion of the effused blood forms a dense fibrinous wall. The possibility of the hæmatocele undergoing suppuration must not, however, be lost sight of. The signs and symptoms in such an event will be similar to those of an intraperitoneal abscess with septicæmia.

Prognosis.—The prognosis in pelvic peritonitis is much less favourable than in pelvic cellulitis. Not only is the mortality higher, but the after-effects, in those patients who recover, are apt to be much more troublesome, and are not unfrequently of a character sufficiently serious to entail a life of chronic invalidism. The disease which caused the peritonitis still remains when the acute attack of peritoneal inflammation has subsided, and constitutes a centre around which fresh attacks of inflammation are continually liable to occur, either from changes in the diseased tissues themselves, or from external agencies (such as exposure to cold and damp) of a nature insufficient to excite inflammation in healthy tissues, but capable of doing so only too readily when the resisting power of the tissues is lowered by disease.

The tendency to recurrent attacks of peritonitis is more marked in cases where the underlying disease is accompanied by pus either in the form of pyosalpinx, suppurating ovary, or intraperitoneal abscess.

The damage done to the uterus, ovaries, and Fallopian tubes during an attack of pelvic peritonitis, especially that done to the tube by the closure, adhesion, or displacement of its abdominal ostium, frequently has the effect of producing sterility; and even if the gradual absorption of morbid adhesions permits the occurrence of conception, the continuance of gestation to full term may be rendered impossible owing to interference with the normal expansion of the pregnant uterus. It is not possible, however, in any given case to be certain that pregnancy cannot thenceforth occur; for experience shows that, even after the most violent peritonitis, the parts may recover themselves sufficiently to permit not only of subsequent conception, but of normal delivery at term. The discreet practitioner, therefore, will always hesitate to commit himself to the opinion that his patient cannot again bear children.

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[1] See the writer's Bradshaw Lecture for 1902, delivered before the Royal College of Physicians, "On Intraperitoneal Hæmorrhage incident to Ectopic Gestation," published in the *Journal of Obst. and Gynæcol. of the British Empire* for Nov. 1902, pp. 409-32; also in the *Lancet* and *Brit. Med. Journ.* for Nov. 8, 1902.

Another not infrequent effect of pelvic peritonitis is permanent interference with the normal action of the bowels due to the implication of intestine in the pelvic adhesions. Occasionally still more serious results follow these adhesions in the form of acute intestinal obstruction.

It must be remembered, nevertheless, that pelvic peritonitis may result in complete recovery, and that the prognosis must be determined by the special circumstances of each individual case.

Treatment.[1]—1. *Preventive.*—Inasmuch as in the large majority of non-puerperal cases pelvic peritonitis is due to gonorrhœal salpingitis, the prophylactic treatment in these cases consists in destroying the gonorrhœal infection before it has extended to parts beyond the reach of local applications. Gonorrhœa in the woman is still regarded in this country as a comparatively unimportant affection, though it probably destroys the health of a larger number of women than does the much more dreaded poison of syphilis. As a rule, the earlier indications of the disease pass unregarded; they are attended with but little pain, often with none when the urethra is not involved, and the significance of the purulent discharge is not realised. For these and other reasons it frequently happens that medical advice is not sought until the infection has had time to inflict serious and sometimes life-long damage on important organs. And even if advice be obtained earlier, the disease is not always treated with the necessary vigour. It does not come within the scope of this article to describe the symptoms and treatment of acute gonorrhœa in the female. It must suffice to point out that a latent gonorrhœa in the male, supposed to have been cured, may be roused by marriage into renewed activity; and that a purulent vaginal discharge, especially if in a recently married woman, should always be looked upon with grave suspicion, and its treatment undertaken with a due sense of responsibility.

The preventive treatment of pelvic peritonitis due to septic salpingitis—which includes (1) nearly all the non-puerperal cases that are not accounted for by gonorrhœa, and (2) all the cases that are traceable to abortion, parturition, and surgical manipulation—consists in a rigid adherence to the rules of aseptic surgery and midwifery, especially as regards the thorough and even elaborate disinfection of hands, instruments, and sponges. By this means only can those engaged in surgical and obstetric practice hope, in the midst of their varied work, to avoid becoming the occasional carriers of septic infection (*vide* p. 751).

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[1] It should be clearly understood that the section on treatment does not apply to cases of pelvic peritonitis suspected to be due to disease of the appendix vermiformis. Pelvic peritonitis, when due to an intestinal lesion, is, generally speaking, more dangerous than when due to salpingitis. Besides, removal of the appendix is not a mutilating operation in the sense that removal of the uterine appendages is. These two considerations have an important bearing upon treatment, and especially upon the advisability of early operative intervention.

In those patients who have once been the subject of pelvic peritonitis it becomes important to avoid such causes as are likely to provoke a relapse. The utmost care, for example, should be exercised to avoid exposure to cold and damp, especially during the menstrual period; and over-exertion should at all times be guarded against. Prolonged standing appears to be attended with consequences quite as disastrous as excessive exercise, and should therefore be avoided with equal determination. It is not often necessary for patients in whom, notwithstanding the existence of chronic inflammatory disease of the uterine appendages, there is no active peritonitis present to be condemned to lie in bed and lead an invalid's life; but it is nevertheless essential to insist upon their obtaining every day definite intervals of rest in the recumbent posture. It will greatly conduce to the formation of regular habits of this kind for the medical attendant to draw up a few simple but definite rules for his patient's guidance, and strongly insist on their being diligently carried out. Scarcely less important than the rigorous avoidance of over-fatigue is the need for constant attention to the state of the bowels. Intestinal adhesions have the almost invariable effect of producing habitual constipation with a tendency to fæcal accumulation, a condition highly favourable to the development and migration through the coats of the bowel of pathogenic micro-organisms. Hence no effort should be spared, by means of suitable aperients, supplemented, if necessary, by enemata of glycerine or soap and water, to overcome in these patients any tendency to intestinal inaction, and to ensure a thorough emptying of the larger bowel every day.

2. *Medical.*—The medical treatment of pelvic peritonitis consists in very much the same measures as those recommended for the relief of pelvic cellulitis, with the important difference that whereas opium and its derivatives are never needed in uncomplicated cellulitis they may be necessary in pelvic peritonitis in order to relieve the acute pain. Even then, however, their administration should be regarded as an unavoidable evil, and should be discontinued at the earliest possible moment. The constipating effects of the opium or morphia should be promptly obviated, all prejudices to the contrary notwithstanding, by efficient aperients or enemata, or both. The accumulation of scybala is much more powerful for harm than the action of purgative medicine, and there should be no hesitation as to the choice of the lesser evil.

Rest in bed is, of course, essential during an acute attack. The diet should be restricted, if not to liquid food, at any rate to food of the simplest and most digestible character, which should be taken at regular intervals so as to allow adequate time for digestion. Pain should be relieved by the application of hot flannel fomentations, and distension by enemata. Should the patient be tormented with thirst, the frequent sipping of hot (not lukewarm) water will do more to alleviate it than either the continual sucking of ice or the drinking of effervescing waters, though there is no reason for withholding an occasional draught of cold water if the patient long for it. If an enema fail to afford adequate relief to the bowels there need be no hesitation in administering a full dose of castor oil (the best of all aperients for the purpose if it can be retained), calomel, or magnesium sulphate.

The state of the pulse, which in peritonitis is ordinarily a much truer guide to the condition of the patient than the temperature, will indicate when stimulants are needed. If the pulse shows signs of flagging—that is, of becoming thin, feeble, and intermittent—brandy or whisky should be given in defined and measured doses diluted with five or six times the quantity of water, and the effect carefully watched, with a view to the increase or diminution of the dose as may be required. Stimulants should not be allowed, however, to take the place of food, but should be given, as far as possible, with food. Any tendency to collapse, indicated by coldness of the extremities, sunken features, flickering pulse, and subnormal temperature, should be further combated by the application of hot water bottles and the subcutaneous injection of strychnia. Of still greater importance is it to bear in mind the intensely depressing effect of intestinal distension, and to adopt means for enabling the patient from time to time to expel accumulated flatus. Nothing answers the purpose so well as small soap-and-water enemata, which, if necessary, may be frequently repeated. The introduction of a soft india-rubber rectal tube is also often of great service; the tube may be left in for a quarter of an hour at a time if its presence is not a serious annoyance to the patient. Turning the patient on to her side is another, sometimes singularly effectual, means of promoting the passage of flatus.

Surgical.—The indications for surgical intervention in pelvic peritonitis due to a lesion of the female generative organs[1] cannot be stated quite so categorically as in the case of pelvic cellulitis due to the same cause. It would, of course, be easy to enumerate the conditions necessitating operative measures if one could deal with them from the point of view of the pathologist. But such a point of view is only attainable after the parts have been exposed or removed in the operating theatre or the *post-mortem* room. Diagnosis at the bedside is at best a matter of inference. It is easy to be wise after the event—to say, with the parts lying exposed before us, this patient ought to have been operated upon and that patient ought not. But those who are brought face to face with the clinical problems presented by the cases during life or before operation often have to acknowledge, in the wise words of Hippocrates, that "judgment is difficult" and "opportunity fleeting."

With regard to the question of operating during the first, or indeed during any acute attack, there seems to be a general consensus of opinion, founded partly on clinical experience and partly on inferences drawn from pathological observations and experiments, that unless the indications are urgent this should be avoided. The difficulty of making a thorough bimanual examination when the parts are so tender, and the vagueness of the physical signs in the early stages of an attack, often render it impossible under the circumstances to say whether the case is or is not one in which, under the influence of time and rest, spontaneous recovery may reasonably be expected to take place; whether, in other words, it is one calling for operation at all. Again, the mortality of operations performed during an acute attack of localised peritonitis is found greatly to exceed that of operations performed when the acute symptoms have been allowed to subside. Although, however, it is generally wise to avoid operative measures during the continuance of the acute symptoms, it is seldom desirable, provided the indications for surgical intervention are sufficiently clear, to defer operation for more than a few days after their subsidence. For it has been shown both by observation and experiment, that for a certain limited time after an attack of acute peritonitis, or, in other words, after exposure of the peritoneum to a sudden and severe infection, the resisting power of the peritoneum is increased, and a degree of temporary immunity has been established (see Herbert Durham's paper on "The Clinical Bearing of some Experiments on Peritoneal Infection," in the *Medico-Chirurgical Trans.* vol. lxxx. for 1897, pp. 191-204). Hence the need for hastening such operative measures as may be necessary, so as to take advantage of the immunising effects of the recent invasion.

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[1] See footnote on p. 545.

To this rule (as to avoiding operation during an acute attack), there are, of course, exceptions as, for instance, where the symptoms indicate a seriously septic condition. In such a case everything may depend upon promptness of action. In desperate emergencies we must, if we wish to save our patient, be prepared to run desperate risks. Where, again, during an acute attack, a tense, fluid swelling is formed in Douglas's pouch, there can be no hesitation as to the propriety of making an opening through the vaginal roof. Even should the inflammatory effusion prove to be only serous, the mere removal of tension will afford great relief, whilst, if the swelling prove to have been a collection of pus, such timely interference will not only afford immediate relief to the more urgent symptoms, but will prevent the bursting of the abscess into the rectum, with the possibilities of an incomplete evacuation and the establishment of a troublesome sinus. A third exception may be mentioned, namely, where a fluctuating swelling is formed in the lower part of the abdomen, and increases rapidly in size. In such a case the need for surgical relief is imperative and urgent, for it is almost certain that pus is present either in the form of an intraperitoneal abscess or a suppurating cyst.

With regard to surgical intervention in the less acute and in the chronic stages of pelvic peritonitis due to lesions of the female generative organs, it is only possible to lay down a few general rules, leaving each case to be judged on its own merits. The duty of the medical attendant is to avoid extreme views in both directions. He should not, on the one hand, oppose the idea of operative treatment indiscriminately. Nor should he, on the other, be too ready to propose surgical measures in these cases, for nothing is more certain than that a very considerable number of them will recover without operation under the influence of time and rest. The first rule to be observed is never to recommend operation unless there are definite physical signs in the pelvis, unless, that is, there can be felt in one or both posterior fossæ an irregular, more or less hard, fixed swelling, pointing to past inflammation of the uterine appendages. If this rule be followed, the medical attendant will never fall into the lamentable error of operating, or recommending operation, in merely neurotic cases. Experience has entirely discredited operative treatment for pain alone, in the absence of physical signs. Gynæcologists should respect the female organs of generation as carefully as the surgeon respects the generative organs in the male. And what surgeon would dream of removing a testicle simply for pain?

Another useful rule of practice is not to operate after a first attack of inflammation, unless the size of the swelling suggests the presence of pus, or at any rate of something more than a mere muco-purulent salpingitis with localised peritonitis around it. Recurrent attacks of inflammation, on the other hand, of themselves suggest the presence of pus, whatever the size of the swelling may be, and are an important indication of the need of surgical treatment.

Again, if, notwithstanding that the patient has been placed under the most favourable conditions for recovery, the pelvic swelling undergoes no diminution, or, still more, if it increases in size, it is obvious that surgical measures are indicated, for it is almost certain either that pus is present or that there is a hydrosalpinx, or a new growth, in all of which cases the desirability of an operation is beyond doubt.

Lastly, the medical attendant must be guided in the advice he gives by the patient's social position. A woman from the labouring class cannot afford to spend several months of her life as an invalid if there be a quicker way to recovery; whereas one who, with ample means, has no necessity for leading an active life, would be perfectly justified, under otherwise similar circumstances, in declining operation until treatment by prolonged rest has been tried and found ineffectual.

It has been decided that, in the present edition of this work, the various methods of operation shall be dealt with in a separate article, to which the reader seeking information on this subject is accordingly referred.

There still remains a class of cases in which operative interference is occasionally attended with signal benefit, that, namely, in which much suffering and more or less disablement are caused, not by definite inflammatory changes in the tube or ovary, but by peritonitic adhesions. The salpingitis that originally started the pelvic peritonitis may have subsided so that there may no longer be any definite swelling in the sides of the pelvis, and yet the peritonitis may have left the pelvic viscera matted together by adhesions of such a kind as to condemn the patient to a life of invalidism. In a large number of these cases the uterus is fixed in a position of retrodisplacement. Under these circumstances separation of the adhesions and permanent restoration of the uterus to its normal position often succeed in removing the symptoms and restoring the patient to health.

The separation of peritonitic adhesions in the pelvis can occasionally be effected, without operation, by the manipulative methods associated respectively with the names of B. S. Schultze and Thure Brandt. But these methods have not found favour in this country, nor are they likely to do so. The objections to them are too obvious to need discussion.

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ON GONORRHŒAL INFECTION OF THE FEMALE PELVIC ORGANS

THE term *gonorrhœa* (γόνορροια) occurs in Galen, and is etymologically synonymous with *spermatorrhœa*, being founded upon an error in pathology. The term *blennorrhagia* or *blennorrhœa* (βλέννα = mucus) avoids the error. But gonorrhœa is now defined as *a disease due to the invasion of the human body by a specific micro-organism named the gonococcus*, and thus it becomes legitimate to speak of gonorrhœal disease of any part in either sex. To the invasion of the gonococcus the female genito-urinary tract is quite as susceptible as the male, but the consequences to the woman are on the whole more permanent and more disastrous, for in her case the gonorrhœal infection has a greater tendency to spread upward from the external to the internal genital organs, and to cause there disease which is inveterate, painful, and deleterious to these organs and their functions.

It is little to the credit of gynæcologists that this most important factor in the causation of diseases which were constantly before their eyes was so long overlooked or under-estimated; and it is to be feared that patients suffered in more ways than one from such oversight. Bernutz and Goupil (4) stand out as honourable exceptions, for in 1857 they had recognised the spread of gonorrhœa to the oviducts, comparing this with gonorrhœal epididymitis in the male; and they adduced statistics to show how frequently pelvic peritonitis occurs in infected women. Their *Clinical Memoirs* will well repay study. But the profession as a whole continued to regard gonorrhœa in women as relatively harmless.

In 1872 Noeggerath of New York published in German an epoch-making work on *Latent Gonorrhœa in the Female Sex* (35). He drew attention to the extreme importance of gonorrhœa as a cause of pelvic disease in women, and also to the infective power of the so-called *latent gonorrhœa*; this he did with emphasis, and with some exaggeration, and in consequence of the strong feeling excited against him both inside and outside the profession, he had to leave New York.

In 1879 Neisser gave the first accurate description of the gonococcus (32), and so introduced an exact method of diagnosis which went far to settle the raging controversy concerning Noeggerath's opinions. For when in various gynæcological clinics on the Continent systematic search was made for the gonococcus in long series of cases, ample proof was obtained of its frequency; and the principal contentions of Noeggerath are now generally conceded. Very much careful and laborious investigation on the subject of gonorrhœa in women has been carried on and a very considerable amount of literature has accumulated (6, 49). Amongst those who have contributed most to the advancement of our knowledge we must especially mention Professor E. Bumm of Basel (now of

Berlin), whose work has been fundamental. To him I acknowledge my indebtedness in the preparation of this article (6, 7, 8). Wertheim of Vienna has done much to improve the methods of pure culture, and to elucidate various points, such as the deeper penetration of the gonococcus and its pyogenic properties (55). The late Professor Sänger was a strong champion of Noeggerath's opinions, and there are many more who deserve our recognition. In England, Lawson Tait was one of the first to insist on the part played by gonorrhœal infection in the diseases of women (52), and to Sir W. Sinclair of Manchester we owe the first adequate account for the English reader of the advances made by observers at home and abroad (47).

For full information on the subject of gonorrhœa in general the reader is referred to standard works on Surgery, Pathology, and Bacteriology. In this article a concise account will be given of the consequences of gonorrhœal infection of the female pelvic organs. Further details of the morbid conditions resulting in special parts, and of their surgical treatment, will be found in other parts of this volume.

Etiology, Frequency, etc.—The requisite proof has been obtained that gonococci exist constantly in gonorrhœa; that pure cultures can be made of this micro-organism; that the inoculation of healthy mucous membranes with such pure cultures causes the disease; and that in the disease so established the specific micro-organism is found in all its virulence. In other words, Koch's four conditions are fulfilled.

The gonococcus, unlike those septic organisms which enter by a wound, can penetrate the living body without any defect of epithelial surface. No individual, it appears, possesses immunity, whether old or young. One attack does not prevent a second; on the contrary, by reinfection an acute is very apt to supervene upon a chronic condition.

Except in the gonorrhœal vulvitis of children, infection is in the overwhelming majority of cases conveyed to the genito-urinary tract by coitus. It is no doubt possible for infection to be conveyed by the use of public closets, or by linen, sponges, vaginal tubes or other fomites, but in most alleged instances of such conveyance it is probable that the infection has been direct. As regards linen the gonococcus is very sensitive to drying, and when dried the secretion loses its virulence.

A very possible cause of infection is the neglect of surgical cleanliness when a series of gynæcological patients are examined in quick succession by the same hands and the same instruments without due disinfection. One hardly cares to speculate upon what may have happened in the days when sounds, hysterotomes, intra-uterine stems, etc., were in constant use, and asepsis and disinfection were not thought of (see *Prophylaxis*, p. 571).

Transmission by sexual intercourse.—The cases which are suitable for discussion here are not those in which gonorrhœa is transmitted by the man when suffering from an acute attack, an occurrence which is relatively rare, but those in which infection is conveyed by men who believe themselves to have been cured of the disease and to be free from infection.

Such instances of infection are not unfrequently seen in young married women. The reason why in both men and women it may be believed that infection is absent while it is still present is as follows:—It is one of the most characteristic features of the action of the gonococcus on mucous membranes that although at first it excites acute symptoms these subside somewhat rapidly as a rule, so that subjective symptoms are trivial or absent, and the catarrhal discharge is small or insignificant in amount; while bacteriological examination may fail to find gonococci in any remains of the discharge; yet that all the time the disease may be uncured, and gonococci may still lurk in some part of the genito-urinary tract. This stage has been described as one of *latency*, and the disease has been named at this time *latent gonorrhœa*; although *chronic gonorrhœa* would be a more accurate name. Gonorrhœa in this stage is infectious, and the infection produced is apt to be virulent, not of the mild degree of an attenuated virus. Moreover, under certain conditions the chronic gonorrhœa may relapse into an acute stage. These etiological factors have the following clinical consequences:—

1. A man may marry whose gonorrhœa has assumed the chronic or latent stage. In the virgin soil of the mucous membrane of the woman's genito-urinary tract, the gonococci may multiply with great rapidity, and acute gonorrhœal inflammation may ensue.

2. This acute process may excite a similar condition in the man, and an erroneous suspicion may arise in his mind that the wife had been previously infected, he being unaware that he is himself the original source of his reinfection.

3. If a married couple who have gonorrhœal infection in common be separated, the husband may in the interval be apparently, perhaps absolutely, cured. When he resumes marital relations, unless his wife has also become free from the gonococcus, acute reinfection may take place (Klein and others, 22).

In regard to the so-called *latent gonorrhœa* it is important to add that Wertheim has shown (55) that there are "involution forms" of gonococcus which no longer stain distinctly, and hence cannot perhaps be demonstrated, but which possess vitality and are capable of virulence. Persistence of infection in cases where gonococci have been sought for in vain for months is thus explained.

While it is true that from chronic gonorrhœa very acute infection can arise, it does not follow that there is no difference in the virulence of the poison in different cases. We believe that the facts relating to the "ascension" of gonorrhœa indicate the contrary.

Etiology of Gonorrhœal Vulvovaginitis in children.—A large proportion of cases of purulent vulvovaginitis in children are gonorrhœal. The occurrence of this condition often excites in a mother's mind a suspicion that the child has been criminally assaulted. The infection is, however, in the great majority of cases, accidental. If a woman have a copious virulent discharge a little carelessness in the use of sponges, commodes, etc., may infect children who perhaps share her bed. Cases are recorded by Bumm, Sänger, and others where three or four members of a family have suffered in this way. A. Martin quotes from Beclère the case of a child, twenty months old, who slept with a mother who had gonorrhœa. The child was not only infected, but suffered from gonorrhœal arthritis in the ankle joint (28). In foundling hospitals and orphan asylums the malady has spread in an epidemic form by the use in common of washing and other appliances, or by the rectal or vaginal use of thermometers in patient after patient.

Birth-infection of the vulva is rare, but not unknown. One wonders it is not more common, but the vulval mucous membrane is less vulnerable than the conjunctival, and the preponderance of head presentations may have some relation to the frequency of ophthalmia. The vulva also is usually washed directly after birth.

Not all purulent vulvitis can be shown to be gonorrhœal. Drummond Robinson (41) was able to demonstrate the gonococcus in but forty-one out of fifty-four cases examined by him. A diplococcus resembling the gonococcus, but not identical with it, has been described by various writers (see M. Sée, 46); but it is stated that the decolorisation by Gram's method differentiates the gonococcus from these. M'Cann describes a diplococcus in vulvovaginitis which resembles it, but which, unlike the gonococcus, is able to liquefy gelatine (25).

Ophthalmia neonatorum when gonorrhœal is evidence of the presence of gonococci in the maternal secretion, and throws light on the relation of gonorrhœal infection to fertility. Before the introduction of Crédé's prophylactic method into lying-in hospitals 12 per cent of the new-born children suffered from ophthalmia. The conjunctiva affords an excellent field for studying the pathological results of the penetrative power of the gonococcus. It is worthy of note that *chronic* gonorrhœa in women excites *acute* ophthalmia in the new-born. Gonorrhœal stomatitis neonatorum has also been observed by Rosinski[1] and others.

Frequency of gonorrhœal infection in women.—Noeggerath certainly formed an exaggerated estimate of the prevalence of gonorrhœa. He thought that four-fifths of the married men in New York had gonorrhœa, and that two-fifths of the married women were infected. He modified this estimate subsequently. In several important Continental clinics systematic bacteriological investigations have been carried out to obtain exact data. Sänger found 230 infected cases in 1930 private and hospital patients, *i.e.* 12 per cent; but later, in examining 161 patients more exactly, the proportion was 18 per cent. Bumm says that of all women who consult the gynæcologist 10 to 20 per cent have gonorrhœal infection (6). Observations made on pregnant women in some maternity hospitals have shown a quarter or more of the patients to be infected; but we know no data for estimating the frequency in English hospital practice.

Pathology—(*a*) *The Gonococcus.*—The gonococcus of Neisser (32) is a diplococcus; the organism consists of two halves separated by a clear sulcus. Each half is of a discoid or coffee-bean shape, a slight concavity marking the two surfaces which face each other. The gonococcus is of large size compared with other diplococci, averaging 1·25 μ from pole to pole; and the sulcus is relatively wide. Not every specimen, however, is characteristic. It increases by fission in a plane perpendicular to the last line of fission, and thus the gonococci form clusters and not chains. They penetrate the protoplasmic envelope of the leucocytes, and are even found within the nucleus. They stain readily with aniline dyes, but are decolorised with Gram's method, a point of diagnostic importance. The process of staining and microscopic examination is easy, and is a clinical method available in daily practice. The pure cultivation of the gonococcus is difficult, and up to the present time has not been simplified sufficiently for routine clinical purposes.

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[1] *Zeits. f. Geb. u. Gynäkol.*, 1891.

The gonococcus is essentially a parasite of the human mucous membranes, and will not grow when inoculated experimentally in animals, not even on the urethra of the highest apes. Nor will gonorrhœal pus excite specific inflammation in animals. It is difficult to make the gonococcus grow outside the human body. Some medium containing albumen is required for the purpose (see *Diagnosis*, p. 569).

(*b*) *Pathological changes caused by the Gonococcus.*—The chief effect of the invasion of the human body by the gonococcus is to excite purulent catarrh on the infected mucous membrane. Here it produces round-celled infiltration and purulent infiltration, and temporary or permanent interference with the functions of the part. The histological processes have been studied, especially by Bumm, in the conjunctiva, and in the male and female genital tracts, and are thus described:—When the gonococci reach a susceptible mucous membrane they begin to multiply rapidly in the mucus upon the surface, and penetrate the subjacent epithelial layer, being found in groups and in "trains" of cocci in the cement-substance between the epithelial cells. The epithelial layer is soon pierced, and the superficial strata of connective tissue are reached. The penetrative power of the gonococcus is remarkable, so that shortly after it has attacked the mucous membrane it cannot be washed away again by the flow of tears or stream of urine or by the use of a lotion. The metabolic products of the gonococcus have an irritant chemical action, in consequence of which extensive migration of leucocytes from the capillaries follows. The round cells accumulate in the upper layers of the connective tissue, and pass from here to the epithelial surface, so that the epithelial layer becomes partly disintegrated, its cells being separated, raised up, or cast off. The gonococci do not, as a rule, penetrate deeply into the connective tissue, but are chiefly confined to the upper layer, and are seen in the fine lymphatics and in the pus cells. Healing takes place, as the cocci are destroyed by the development of bactericidal secretions in the tissues. From the remnants of the epithelial layers a new cover of squamous epithelium is developed, and further penetration of the cocci from the surface does not take place (6, 8).

The gonorrhœal process is thus for the most part superficial; but it is now well established that deeper extension does sometimes take place, and that suppuration may occur in the deeper layers.

Gonococci have been found in the peri-urethral, peri-ovarian, and peri-rectal connective tissue, and in the subperitoneal lymphatic spaces (22). Wertheim especially has investigated this question. Bumm and other authors have ascribed such suppuration to a mixture of other pyogenic organisms with the gonococcus. Wertheim maintains that the presence of such organisms is not necessary, and he has advanced evidence to show the pyogenic powers of the gonococcus itself (31). Healing in a simple mucous membrane like a conjunctiva tends to be early and complete; but in a mucous membrane of complicated structure, such as that of the female genito-urinary tract, the germs persist in folds, follicles, gland-ducts, and other places, and become the source of new infection.

When the *urethra* is affected the process in acute stages resembles those just described. In chronic stages, where gonococci are found, the mucous membrane shows patches of disease, which present an eroded, brawny, or papillary appearance. The female urethra is very rich in follicles, especially near and around the meatus; and these are apt in chronic stages to be the seats of gonorrhœal inflammation.

The vulva, vagina, and vaginal portion of the cervix are covered with stratified epithelium; this tends to thicken under external influence, as in patent vagina and in prolapse. These parts of the genital tract offer in the adult considerable resistance to the entrance of the gonococci, and gonorrhœal vaginitis is by no means a common or prominent lesion. But in children where the mucous membrane is tender, soft, and moist; in old women with atrophic conditions; during pregnancy, and in women of delicate build, especially blondes (Sänger), the gonococcus invades the tissues. Secondary vaginitis may also be caused by the virulent cervical discharge passing over the mucous surface. In such cases reddening and swelling of the mucous membrane, with prominent papillæ, purulent catarrh, and eroded patches are seen.

The glands of Bartholin are a common seat of gonorrhœal inflammation, and the condition is described under the convenient if somewhat odd name *Bartholinitis*. The infection is for the most part limited to the ducts of the glands; the glands themselves commonly escape. The gonococci invade the cylindrical epithelium, and changes similar to those already described occur; but the lumen of the duct is apt to be occluded, and this leads to cystic distension of the duct, and a so-called Bartholin's cyst is thus formed. When the contents of this are purulent a pseudo-abscess is produced. The whole of the gland may sometimes show purulent infiltration with suppuration in the connective tissue; a true abscess is then present. Suppurative Bartholinitis is not necessarily gonorrhœal.

The *cervix uteri* is the most important seat of primary infection. Its epithelium is cylindrical, and is easily attacked by the germ; free secretion is poured out, and round-celled infiltration is found between the glands. The ducts are liable to be invaded, but the glands themselves usually escape (Bumm). In chronic cervical gonorrhœa the disease is limited to tracts of tissue. Here, as elsewhere, when the cylindrical epithelium is lost squamous epithelium takes its place. In acute stages the cervical mucous membrane may be everted at the os. Retention cysts (ovula Nabothi) often form, and the cervix is often eroded. Erosion of the cervix, says Klein (22), is for the most part of gonorrhœal origin. This it is rather difficult to believe.

In gonorrhœa of the corpus very extensive round-celled infiltration is found between the glands; in other words, there is interstitial endometritis. The changes are confined to certain portions of the endometrium. Here, as in the cervix, the ducts rather than the deeper part of the gland are affected by the gonococci. Increase of glands may also occur. Gonococci are found more plentifully in the body than in the cervix. Bumm found the disease relatively superficial; Wertheim noted a deeper penetration. In many places he found inflammatory changes in the muscular coat, and small-celled infiltration of the connective tissue in the muscular layer in isolated tracts, with consequent thickening of the walls of the vessels, and hypertrophy of connective tissue at the expense of the muscular fibres. It is in the body and cervix that gonococci lurk in the so-called "latent gonorrhœa," where they lie beneath the newly-formed epithelial scales or in the gland-ducts. When from any cause the scanty secretion is augmented, as under the influence of irritation, the gonococci multiply fast, and the secretion becomes highly virulent.

With the ascension of infection above the uterus the lesions become more gross and the consequences more serious. The chief possibilities are *purulent salpingitis*, *pyo-salpinx*, *ovarian abscess*, *pelvic peritonitis* with adhesions, and occasionally *diffuse purulent peritonitis*. The views of Wertheim—in his paper on ascending gonorrhœa in women (54)—that the gonococcus can accomplish the above results without the admixture of other organisms, is now generally accepted. Döderlein, who declares the matter to be beyond doubt, mentions three cases in point (11). In each case a married woman was infected by her husband, who, having been infected by impure coitus with a third person, had transmitted the disease when suffering from an acute attack; in each instance the consequence was a violent outbreak in the woman. All three showed the worst symptoms of ascending gonorrhœa, and in from two to three weeks acute peritonitis developed. Abdominal sections were performed. The oviducts were not occluded and pus exuded on pressure. There was diffuse peritonitis, and in the fibrino-serous fluid taken from the upper part of the abdomen gonococci were found as freely as in acute urethral gonorrhœa or ophthalmia neonatorum. Nevertheless, diffuse purulent peritonitis is the exception, localised peritonitis is the rule, and the gonococci do not usually develop in the peritoneal cavity; they reach it through the oviduct, but soon disappear. In purulent salpingitis there are the phenomena incident to purulent catarrh elsewhere. The plicæ of the mucous membrane are thickened, there is very extensive small-celled infiltration in the coat of the oviduct, the connective tissue shows hyperplasia, the serous surface is reddened, inflamed and covered with a fibrinous exudation. Gonococci have been satisfactorily demonstrated in the oviduct and on its walls, extending to the peritoneal coat. When the ostium externum is occluded pyosalpinx results.

The oviducts are usually affected bilaterally, but not always in the same manner. A pyosalpinx may form on one side, while on the other may be only purulent salpingitis with thickened mucous and muscular coats. The ovaries are infected from the oviducts, and ovarian abscess may form in which gonococci are demonstrable. As the ovaries are affected the peritoneum also is invaded by the gonococci, either by exudation of pus through the fimbriated end of the oviduct, or by penetration of its serous coat. The oviduct now becomes adherent to the ovary, and adhesions form with the surrounding parts, such as the uterus, bladder, pelvic wall, omentum, large and small intestine, and even vermiform appendix. Thus the ovary is embedded in the centre of a so-called *adnexal tumour*, is seriously damaged, and its functions more or less interfered with. The Graafian follicles may be atrophied or destroyed, or a ruptured follicle may give entrance to gonococci and become the seat of an abscess. In these abscesses, as in pyosalpinx, after a while gonococci are no longer found. The abscesses may perforate into rectum, bladder, vagina, etc., and chronic discharging sinuses may result.

That *gonorrhœal parametritis* can occur from the penetration of gonococcus into the pelvic cellular tissue is probably true. This occurs almost exclusively in connection with child-bed, and mixed infection may play a part.

Gonorrhœal infection in relation to pelvic surgery.—Wertheim has said that gonorrhœal infection is the chief cause of suppuration in the pelvis, a dictum which Kelly adopts (19). This point is worthy of attention in relation to operations for myoma, etc. Cæsarean section, plastic operations, and the like. A bacteriological investigation may give the surgeon valuable guidance as to whether the patient is fit for operation, and as to choice of methods ; as, for instance, whether in a given case a conservative Cæsarean section or a hysterectomy should be performed.

Mixed infection.—The question whether the pathological changes which follow the invasion of the gonococcus are due to this alone, or whether they are also due to the admixture of other pyogenic germs, has been the subject of much controversy. Wertheim, as we have seen, has shown the potency of the gonococcus to excite suppuration. In 116 cases of pyosalpinx he found in seventy-two no bacteria, in thirty-two gonococcus, in six streptococcus, in one staphylococcus ; and there is a good deal of evidence that the plentiful development of gonococci is not favourable to the growth of other micro-organisms, although these have sometimes been found. Also Döderlein and others have shown that, when the gonorrhœal process begins to subside, there is a change in the *flora* of the mucous membrane. This is seen also in the male urethra (Muir and Ritchie, 31).

Again, in the persistent gleet which sometimes follows acute gonorrhœa of urethra and cervix, even though gonococci are no longer found, several observers have noticed the continuous presence of a short and rather small diplo-bacillus, which seems to be a sequel to gonorrhœa. Its significance is not fully understood (Klein, 21). As M'Cann well puts it, the complications of gonorrhœa may be due to the gonococcus or to other germs mixed with it, or to secondary infection by other germs which have followed and supplanted the gonococcus, or to the toxic products of the gonococcus or of other bacteria. He ascribes a considerable part to secondary infection (25). So also Schäffer says that the gonococci prepare the way for the pus cocci, so that in later stages we have to do with a mixed infection (45).

Toxic products of the Gonococcus.—Some interesting observations have been made to determine how the gonococcus excites inflammation and local and constitutional symptoms; the conclusion seems to be that a virulent toxin is produced by and in the cocci. This has been named *gonotoxin*.

Wasserman (54) placed cultures of gonococci in nutritive serum with peptone bouillon, then killed the gonococci, and investigated the poisonous properties of the fluid. The smallest quantities of the poison, when injected into animals, excited local inflammation with fever, swelling of the nearest lymphatic glands, severe pains in muscles and joints. The poisonous principle seems to be found in the substance of the cocci themselves, for when by filtration these are removed the filtrate has not the same properties. Experimental explanation is thus given of the symptoms of gonorrhœal arthritis and gonorrhœal rheumatism, and of the infective nature of gonorrhœal pus when encapsulated, even when gonococci are no longer growing in it.

Malovski has also experimentally confirmed the formation of gonococcus toxin, and its powers of exciting local and general symptoms (29). Wertheim has made similar observations. Attempts to obtain an antitoxin have hitherto failed.

Course and Symptoms of Individual Lesions.—The effects of the invasion of the female genito-urinary tract by the gonococcus vary from a limited and transient catarrh, which almost escapes notice, to extensive disease of the pelvic viscera, which disorganises them in structure and function, and ruins the health of the patient. In the slight cases the woman may not consider that she is ill, still less that she is a source of infection. The lesions from which symptoms may result are *urethritis*, with possible ascension to bladder and kidneys, *vulvitis*, *vaginitis*, *Bartholinitis*, *endometritis* of cervix and of body, *salpingitis*, *ovaritis*, *peritonitis*, *parametritis*, *proctitis*. Also metastases may occur.

This multiplicity of lesions is very characteristic of gonorrhœa in women. We will first consider them in detail, and will then discuss the varied incidence of the disease and the clinical course as a whole.

Gonorrhœal Urethritis.—In the male gonorrhœal urethritis and its consequences are so prominent and important, that gynæcologists are struck with the fact, that in the women who come to them for treatment for gonorrhœal infection the urethral symptoms are inconspicuous or absent, whilst stricture of the urethra is an extremely rare condition. In recent infection, however, urethritis is almost constant, but the symptoms are transient, and the purulent discharge is soon reduced to a minimum. Nevertheless, if patients who seem at first to show no symptoms and to have no discharge, be examined when they have not micturated for some hours, and if pressure be then made upon the urethra, from the vaginal side, squeezing it against the symphysis, a drop of pus may be made to exude which may contain gonococci. Gonorrhœa begins in the female urethra from one to three days after infection, with yellowish serous discharge which at first is only slightly turbid, but which in three or four days becomes purulent. The mucous membrane becomes reddened and swollen, and more or less eversion can be observed at the meatus urinarius, which is red and congested. The whole urethra is tender, and the insertion of an instrument causes pain and bleeding. The subjective symptoms are often very slight, and the general health suffers little. Frequent and painful micturition may be present, with burning and smarting in the urethra and vulva, and perhaps tenesmus. Pus cells, epithelial scales, flakes and shreds of mucus are found in the urine. The symptoms soon subside, the parts assume a normal appearance, the discharge becomes thin and inconsiderable, and in three or four weeks the only obtainable evidence may be the drop of whitish discharge containing gonococci which can be expressed from the urethra.

Under the influence of local irritation recrudescence of the specific inflammation may occur. It is an important fact that in the case of urethritis, as well as in gonorrhœal disease seated in other parts of the genito-urinary tract, local irritation, the unwise use of instruments or chemical agents, sexual or alcoholic excess, violent exertion in acute stages, and especially exposure to reinfection, militate against that complete and early cure which it is of urgent importance to obtain. Any constitutional weakness, such as anæmia, chlorosis, tuberculosis, etc., tends to promote persistence of the disease.

Sometimes a chronic and inveterate form of urethritis is seen. This is characterised by the persistence of a small amount of secretion containing gonococci, and by a more or less granular condition of the mucous membrane, with eversion at the meatus. The thickened urethra may be felt through the vagina. Stricture of the urethra, though very uncommon, does sometimes occur, as Dr. Herman has shown in a paper on the subject (16); but he could collect only eight cases with gonorrhœal history, and not all these were beyond doubt. The inflammation and enlargement of the peri-urethral follicles which occur in the chronic form have been studied specially by French writers. A detailed account of the subject has been given by Verchère (53). Such follicles are seen as small red spots on the everted mucous membrane and around the meatus. They may be pedunculated. The tubules of Skene are especially liable to infection, and peri-urethral abscess may form (see Plate, Figs. 1 and 2).

The ascension of gonorrhœa to bladder, ureter, and kidneys is rare but not unknown. In the bladder small fissures may form around the neck, and a condition of so-called "irritable bladder" may result. Bumm points out that in gonorrhœal cystitis the urine will usually remain acid, since the gonococcus does not cause ammoniacal decomposition. A very striking case of gonorrhœal pyelitis is recorded by Kelly (20).

Gonorrhœal Vulvitis.—The reasons which make this rare, and the conditions under which it occurs, have been already stated. In gonorrhœal vulvitis a copious discharge of pus attracts attention; crusts are formed on the genitals, and the surrounding parts of the thigh and perineum are erythematous or eczematous. The labia minora, glans, and frenum clitoridis become œdematous and prominent. On wiping away the purulent layer eroded patches are found which bleed easily; small fissures are formed, and pus lurks in all corners. The inguinal glands may be tender. In adults the pubic hairs become matted, and in dirty women an offensive odour is the result.

The symptoms complained of are heat, with burning pain, and scalding in micturition, and perhaps tenesmus. Walking and sitting may be so painful that the patient prefers to lie upon her back with thighs abducted. The disease tends to heal quickly, except in children. At the end of a week the symptoms may be much relieved; at the end of two weeks little trace of disease may be left. The minute vulval glands, which are numerous in the fossa navicularis and elsewhere, are apt to become the lurking-place of the gonococcus, and pus may exude from them on pressure. This condition has been described as *blennorrhagic follicular vulvitis*, and it is very intractable (Astruc, Ricord, Vidal, Martineau). In prostitutes and others who are subject to continued infection and irritation, the follicular enlargement may attain great development. Oberländer, who had at Dresden good opportunities of continuous observation, has described and figured these conditions very graphically (38), see Plate, Fig. 1.

Condylomata acuminata may occur in the vulva and perineum as a consequence of gonorrhœal irritation, but they are not necessarily due to gonorrhœa. They may also occur upon the vaginal portion of the cervix, as depicted by Schäffer (45) in his *Atlas and Epitome of Gynæcology*, plate No. 28. (See also Neisser's *Stereoscopic Atlas*, No. 188 (34)).

Gonorrhœal inflammation of Bartholin's Glands.—Gonorrhœal Bartholinitis may come on at all stages of the disease, and may occur even in children, but this is not common. The disease is usually bilateral, especially in the chronic cases; but suppuration may occur in one side only. Purulent catarrh of the duct is the first symptom, which soon settles down into a kind of gleet, but on local irritation is apt to become purulent again. The external aperture of the duct shows a red granular papular spot which Sänger has called the *macula gonorrhoica*. This is seen on either side just outside the hymen near the lower end of the vaginal opening, and pus may be made to exude on pressure (see Plate, Fig. 2).

GONORRHŒAL INFECTION OF THE FEMALE PELVIC ORGANS

Fig. 1 is taken from Oberländer (38). It illustrates extreme chronic inflammatory changes due to gonorrhœa. The myrtiform caruncles are hypertrophied; the periurethral follicles are enlarged, and at the entrance of the vagina are seen eroded patches covered with dirty, dry, epithelial cells.

Fig. 2, from a case of gonorrhœa with very slight lesions (patient in the Leeds Infirmary, aged twenty-two). The urethral mucous membrane is everted at the meatus, and the openings of Bartholin's ducts show well-marked maculæ. Small red follicles are dotted over the urethral mucous membrane and around the hymen. From one of these a drop of pus was taken which contained gonococci. The patient complained of slight dysuria only.

For Plate.

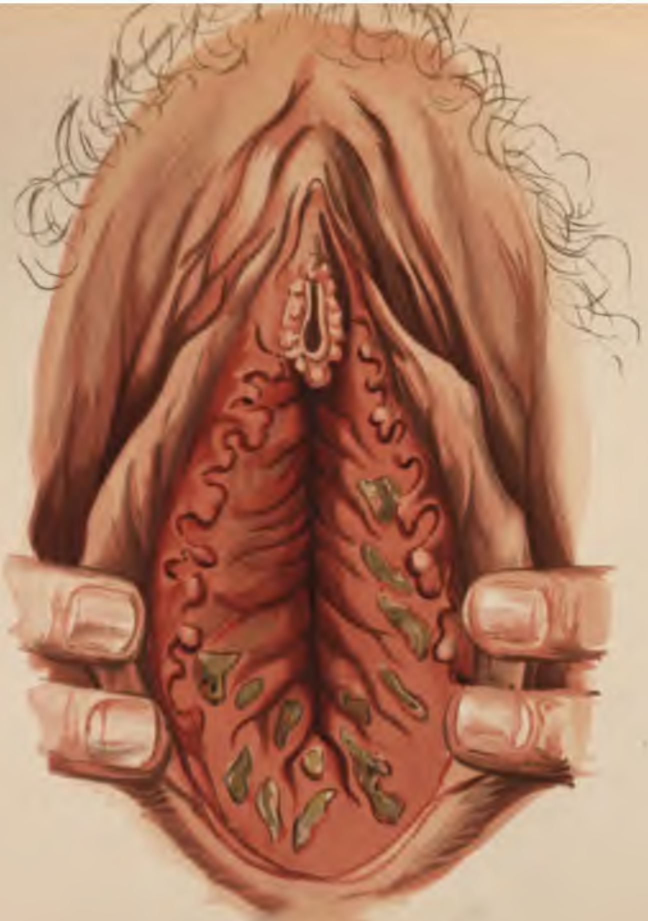
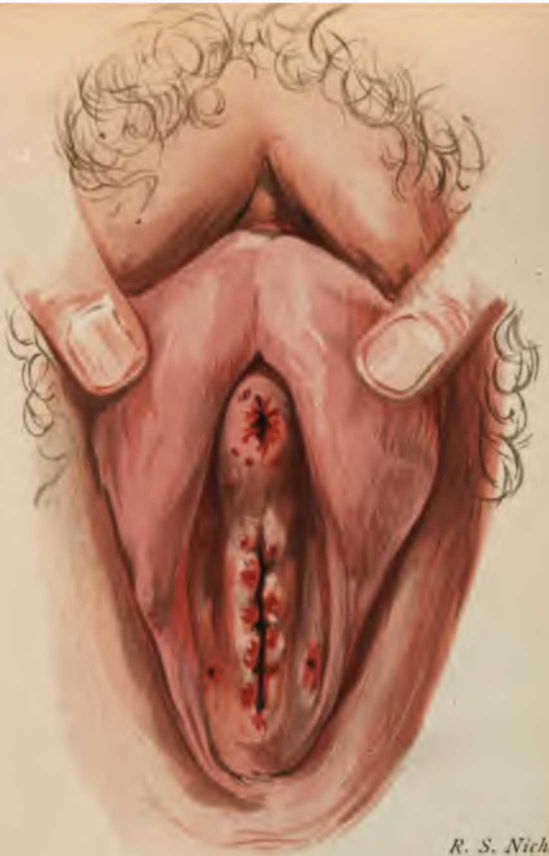


Fig. 1.



R. S. Nichol, del.

Fig. 2.

In cases of occlusion and commencing cystic distension of the duct the swelling can be felt by grasping the labium between the finger and thumb, making comparison also between the right and left sides. In case of considerable distension the swelling may be found to extend deeply towards the perineum. In acute cases the symptoms are those of abscess, and may be severe. In chronic cases discomfort may be but slight. Schäffer's *Atlas* (45) gives good representations of this disease (plates 25 and 26).

Gonorrhœal Vaginitis.—As said previously, the comparatively thick squamous epithelium of the adult vagina resists the invasion of the gonococci; virulent secretion from the cervix may flow through the vagina without infecting it. Bumm failed to produce the disease here by inoculation experiments. It was formerly supposed that gonorrhœal vaginitis was a common lesion; probably this view was based on assumption rather than demonstration. In children and in the rare cases found in adults, purulent catarrh and a tumid mucous membrane with superficial erosions are present. In later stages gonococci occur plentifully with admixture of other organisms. The symptoms present are a sensation of heat, burning and tension in the external parts, with perhaps abdominal tenderness and pain, which may be acute on movement. In exceptional cases observed by Bumm slight rigors and pyrexia were noticed. These symptoms soon subside. Chronic gonorrhœal vaginitis practically never occurs.

Gonorrhœa of the Cervix and Corpus.—More serious symptoms are here produced, for in the uterus the gonococcus finds a soil where it can develop freely, and where it long maintains its vitality, causing functional disturbance and interfering with health. The cervix is a very frequent seat of primary infection, the disease being primarily implanted there by coitus. For a long time the gonorrhœal process may halt at the os internum, and so long as it is confined to the cervix the worst symptoms are not developed.

The acute stage of uterine gonorrhœa is not often seen by the gynæcologist. When such a case is examined by speculum there is usually a great deal of purulent secretion in the vaginal fornices. When this is wiped away a red congested cervix is seen which is tender on pressure. The tumid cervical mucous membrane is everted at the os, the cervical follicles show an acne-like appearance, and pus may be obtained from them. Pain is seldom severe, for in this condition, as in cancer and other diseases, the cervix shows little sensitiveness to pain. When the disease spreads to the fundus much more acute symptoms set in and the condition is practically identical with what has been described in text-books as "acute metritis." The uterus is extremely tender to touch, and even to the jerk of walking, etc. The body is tense and bulky, ante- or retroverted. The lower part of the abdomen is tender, and the patient has a sensation of throbbing and tension and uterine cramps; bearing down and tenesmus may be felt. Rigors and pyrexia occur, but there are considerable variations in the severity of attacks. The acute symptoms usually soon subside, but the discharge remains.

It is in the chronic stage that the disease is usually first seen. When questioned as to their clinical history, the women will often say that some time previously they had "inflammation in the body," referring to the acute stage. The symptoms of which they now complain are variable and not distinctive. They have menstrual excess with aching in the back and groins, leucorrhœa, etc. The cervix may not show very well marked changes. The cervical discharge is mucopurulent, or else clear and glairy; it contains gonococci, and is virulent. The cervix may or may not be eroded, but the os will usually present a red inflamed area with a little erosion of the cervical mucous membrane. Some of these patients feel well or nearly so, and do not seek advice, yet they are liable to relapses, when pain and purulent discharge are increased. But many others apply for treatment, who furnish a considerable proportion of our chronic gynæcological out-patients. They have a bulky retroflexed uterus, backache, and "bearing-down," menstrual frequency and excess, and nervous, gastric, and other general symptoms. Gonococci may be found in the cervical discharge, and may persist there for months or even years (Bumm), especially when, as amongst the poor, the patients are overworked and underfed, with unhealthy environment and perhaps some tendency to alcoholic excess.

Gonorrhœal Salpingitis, Peritonitis, and Ovaritis.—The extension of the inflammation from the uterus to the oviduct does not usually follow immediately on the infection of the fundus, although this may happen occasionally, as in cases already quoted.

Endometritis may exist for months before salpingitis follows. Gonorrhœal salpingitis always begins with acute symptoms, although these may be masked by those of acute endometritis; when the uterine condition is chronic the onset of the tubal affection is well defined (Bumm). There is first pyrexia with perhaps a rigor, and the temperature may rise three or four degrees. It will usually gradually return to normal in about two weeks, sometimes more quickly. There is tenderness on both sides and pain on one or both, and the patient has to remain in bed. Menstruation becomes more frequent, more profuse, more painful. There is fixed dull and continuous pain between the periods, the abdominal muscles are rigid over the tender area, and all movements imparted to the uterus hurt the patient.

As salpingitis is so exceedingly apt to be associated with peritonitis it is not easy to discriminate the symptoms of the two conditions. Peritonitis is the immediate cause of much of the pain with which salpingitis is associated. After the onset of salpingitis has been noted, a fresh attack of pain and tenderness with renewed fever is probably due to peritonitis, and recurrent attacks of localised peritonitis are exceedingly characteristic of this condition. In the same way ovaritis arises without any new symptoms, but with an exacerbation of former manifestations, especially if an abscess be forming.

If we make a bimanual examination an anæsthetic will be required, and the recto-abdominal bimanual gives the most information. It need hardly be said that such an examination must be made with gentleness and caution, for any vigorous handling of the parts, especially pulling down the cervix with vulsellum forceps, may rupture adhesions and cause extension of purulent exudation. The examination may reveal oviducts, slightly thickened, somewhat less mobile than normal, and ovaries of normal or too great size, free or fixed. In more advanced cases such enlargement and fixing are obvious, the uterus loses mobility, and there are signs of perimetric exudation. It is a very common thing to feel a somewhat ill-defined mass behind or on one or both sides of the uterus, consisting of the appendages matted together and fixed in the pelvis, other structures being also involved as already described. To differentiate the component parts of such an "adnexal tumour" is now impossible, but it may be easy to recognise that some portion is cystic.

What is likely to be the fate of such infected appendages? As soon as the oviducts are infected their condition is precarious and their future doubtful, but it is not beyond hope. Gonorrhœal salpingitis may be recovered from, and the oviducts may subsequently be functionally active. Bumm gives a well-observed case in which a patient had clear symptoms of salpingitis directly after marriage, with gonococci and signs of tubal disease on palpation. The symptoms subsided under rest and treatment. Six months later gonococci were still demonstrable, but other signs and symptoms had disappeared, and a year and nine months after marriage she bore a living child. In other cases the symptoms become slight and easily bearable, and the patient enjoys a large measure of health and activity, but she remains sterile and has acquired dysmenorrhœa; gonococci are no longer found, nothing of a serious nature appears, and at the menopause the pelvic troubles are over.

Unfortunately a much more serious clinical history may have to be recorded; the appendages may be involved to the fullest extent, the health fails completely, the patient is never out of pain. She has dysmenorrhœa, chronic leucorrhœa, obstinate constipation, and irritable bladder and sterility. She is thin, pale, weak, bedridden, has little appetite and bad digestion. She has neuralgias and various other nerve symptoms, and is mentally depressed. She goes the round of the doctors and hospitals, loses all pleasure in life, and remains a chronic invalid. The term *cachexia gonorrhoica* has been applied to this condition. Operative interference and extirpation of affected viscera may be followed by restoration to health, but it does not follow that even after radical surgical measures the patient will certainly have no more pain, for pelvic neuralgia may still remain and adhesions may give trouble. And yet even in the worst cases a measure of improvement may take place without operation. A pyosalpinx, or an ovarian or peritoneal abscess, may discharge by the rectum or in some other direction, leaving a sinus which ultimately ceases to discharge. Inflammatory swellings may subside, by absorption; the hyperæmia ceases, the tenderness abates, the chronically inflamed organs become sclerosed and shrunken. Peritoneal adhesions also may certainly undergo solution. In such cases, especially after the menopause, the patient may improve greatly. Long and tedious in the extreme is such a history, and many a relapse marks its course; a directly fatal issue from any of the above conditions is, however, a rare event.

Gonorrhœa of Rectum and Anus.—Baer (2) examined 191 women with genital gonorrhœa, and found the rectum affected in 35 per cent; so that gonorrhœal infection in this part must be more frequent than has hitherto been realised. The fact that vulval discharge passes over the anus explains much of the causation, but infection may be conveyed in other ways, as by the thermometer or enema syringe. Also the practice of passing the finger first into the vagina, and then without disinfection into the rectum, is liable to convey the germs. Purulent catarrh is set up, and heat and burning and dyschezia may be marked for some time, and when these pass away small fissures may remain and give trouble. The loose folds at the anus may be swollen and red, and we have known patients with vulvitis to come saying that they were suffering from "piles." Rectal gonorrhœa usually heals in a few weeks, but it is said that the deeper layers of the mucous membrane may be affected, and that contraction, abscess, or fistula may result.

Metastases.—Metastases occur in women less commonly than in men. "Energetic" treatment with instruments or caustics is said by Klein (22) to favour metastasis by damaging the mucous membrane and facilitating the penetration of gonococci. Arthritis is the most common form in women, the knee being most frequently attacked; but several joints may be affected at once, and endocarditis may occur. A remarkable and fatal case of endocarditis following gonorrhœal infection is given by Hallé (14), which is especially instructive because the local genital condition was trivial. (See also the articles on "Gonorrhœal Rheumatism" in Allbutt's *System of Medicine*, vol. iii., and on "Systemic Gonorrhœal Infection" in Osler's *Principles and Practice of Medicine*, Ed. 4, p. 255.)

Clinical course and Prognosis.—Such being the possible consequences of gonorrhœal infection, it is desirable to form some estimate of the relative frequency of the various lesions, and of the extent to which the worst possibilities are likely to be realised.

The cases are roughly divisible into a milder class, in which the infection does not extend above the os internum, and a more serious class in which the upper part of the genital tract is invaded. Almost all women who are infected have urethritis, though as previously said this may escape notice. Thirty-six per cent have infection of the vulvovaginal glands (Klein, 21). This may cause symptoms so acute as to lead the patient to seek advice, and she is usually cured by radical surgical methods Vulvitis and vaginitis are seen principally in childhood, and usually soon yield to treatment. Of every ten women who have gonorrhœa seven have cervical gonorrhœa (70 to 74 per cent, Bumm; 50 to 70 per cent, Klein).

As we have seen, the serious question in prognosis is, Will the disease ascend farther? The term *ascending gonorrhœa* was introduced by Wertheim (55). It is not easy to say in what proportion of cases the gonococcus passes the os internum, for the cases of mild infection do not come to the hospital; it is the ascension which brings the patients there. So far as one can judge from published figures the body is affected in one-fourth of the cases. Further extension to the appendages is estimated to occur in from 13 per cent (Bumm) to 20 per cent (Herman and others). Von Rosthorn in forty operations for diseased appendages (42) found eight undoubted gonorrhœal cases. The ascent of infection from cervix to fundus, and from fundus to oviducts, is usually determined or favoured by some contributing cause. Such are continued cohabitation with an infected male, sexual excess—especially in close relation to a menstrual epoch—alcoholism, unwise use of sounds, tents, or irritant applications. Abortion and labour are often followed by ascension, and at the time of menstruation special care is required. Violent or long-continued bodily exertion in an infected person, especially soon after parturition, is another determining cause.

Thus we see in regard to prognosis as a whole that acute gonorrhœa tends to subside, and that there is a possibility of its cure, but that the prognosis greatly depends upon prompt recognition of the disease and putting the patient in the best possible condition for recovery.

Ascension of gonorrhœal infection may take place in *children*, and it is possible that certain cases which later in life come under treatment for dysmenorrhœa and sterility may thus originate. Sänger, in 1888, spoke of finding in young patients of from fifteen to twenty years of age traces of pelvic peritonitis probably due to this cause. Cases are also recorded where acute salpingitis and pelvic peritonitis have followed vulvo-vaginitis in children, and the diagnosis has been verified by abdominal section. This complication is, however, extremely rare. The great proportionate length of the infantile uterus may help to protect the fundus. A. Martin in a recent graduation thesis (28) has given a good account of the subject, but has not been able to find many cases. Some recent careful observations by Jung of Berne (18) confirm the opinion that while corporeal endometritis is occasionally present in children it is most uncommon. He found gonorrhœal infection of the cervical mucous membrane twice in twenty cases, and in forty cases of vulvo-vaginitis in children admitted to hospital there were no symptoms of ascension. It is interesting to know that vaginal injections were used freely in those cases without any ill effect.[1] A word may be said here on the relation of gonorrhœal infection to *pregnancy* and the puerperal state. A. Martin of Greifswald in a recent paper well sums up our knowledge of this question. We know to-day, he says, that a woman infected with gonorrhœa may conceive, may go to term, may bear a living child, and pass through a normal puerperium; but on the other hand pregnancy may be interrupted by premature expulsion of the ovum, severe illness may occur in the lying-in period, or if no marked symptoms show themselves at the time serious disease may be found later, requiring radical surgical measures, and even by them perhaps not perfectly cured (27).

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[1] Some cases in point have been recently published by Bidwell and Carter (5).

Gonococci have been found in the placenta at term (30). For a woman previously healthy to receive acute infection from her husband just after lying-in is especially dangerous. In addition to cases already quoted the writer has known one or more instances in the Leeds Infirmary which bear this out, where diffuse purulent peritonitis has resulted, probably from this cause. He has also seen evidence to connect amnionitis and amniotic adhesions with gonorrhœal infection *in utero*.[1]

Prognosis as to Sterility.—The frequent occurrence of gonorrhœal ophthalmia in the new-born reminds us that gonorrhœa does not prevent conception in the majority of cases, for maternal gonorrhœa is usually acquired before conception. Bumm relates the case of a woman who had acquired cervical gonorrhœa, who in two years had one normal birth and two miscarriages, and then after eight months became pregnant again, and went to term. The possibility of conception after salpingitis has already been mentioned. Still, gonorrhœa is a very frequent cause of sterility; or a woman may bear one child and never conceive again. Sänger called this "one-child sterility." This may be because the oviducts and ovaries are disorganised, or because the diseased endometrium is unfitted for the implantation of the ovum, or because the ovum becomes diseased and dies. The well-known sterility of prostitutes will occur to the reader. It is said that 12 per cent of all marriages are sterile; in one-third of all sterile marriages the impotence lies with the husband; in two-thirds the cause is gonorrhœa.

Diagnosis.—This rests on the evidence of clinical history and clinical and bacteriological examination considered as a whole. It is in the chronic stage that the chief difficulties occur. Certain sources of fallacy must be borne in mind. Septic puerperal infection can cause uterine, ovarian, tubal, and peritoneal lesions similar to those produced by gonorrhœa. Muco-purulent discharge from the female genital tract has a wide variety of causes; an irritating leucorrhœa, which is not gonorrhœal, may cause a transient urethritis in the male, and not all ophthalmia in the new-born is specific. The leucorrhœal discharge found in the vagina may contain a great variety of micro-organisms; not all diplococci are gonococci. Steinschneider (50), following Bumm, describes five kinds of diplococci that may be found in the genital tract (see also article by Sée, 46). The distinction is not always very easy. On the other hand, cases which are known to be gonorrhœal may show little specific sign, and the gonococci which are present may elude discovery.

Clinical history.—The patient often gives no clinical history which is helpful. Certain facts, however, may be strongly suggestive of gonorrhœal infection. If she is a married woman who before marriage was quite free from pelvic symptoms, if shortly after marriage and without obvious cause she began to complain of such symptoms as dysuria, copious leucorrhœa, dysmenorrhœa, menstrual irregularity with a tendency to frequency and excess, pain on walking, frequent or fixed pain in the ovarian regions, if she has remained sterile, and especially if she gives a history of repeated attacks of so-called inflammation in the "body" or "bowels" or "womb," then gonorrhœal infection is very likely to have been the cause. Further evidence would be furnished by the fact that she had had an abscess in the vulva, or that she had borne a child who had suffered from ophthalmia of the new-born. In many cases the husband, when questioned privately, would frankly answer any questions put to him, and would even submit to examination.

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[1] Jardine has published a case where purulent ophthalmia occurred in an infant delivered by Cæsarean section. (*Trans. Obstet. Soc. Edin.* vol. xxix.)

Clinical examination.—In acute stages the purulent inflammation, the reddened and swollen mucous membrane, the erythema of the adjacent skin, and the unusual abundance of smegma, will suggest the cause and bacteriological investigation will confirm it. In chronic cases the following signs are worthy of note: "maculæ gonorrhoicæ" may be seen on each side at the opening of Bartholin's ducts; they become more evident if the mucous membrane be firmly wiped with a piece of gauze; and pus may be made to exude from the ducts on pressure. Such maculæ are not absolutely pathognomonic, but the exudation of pus is very characteristic of gonorrhœa. The meatus urinarius may be everted, and small red follicles may be seen on the everted portion, around the meatus, or at other parts of the vulva, and from these pus may be obtained. Other signs are redness and swelling of the myrtiform caruncles, with granular spots here and there, bright red erosion at the os uteri with purulent discharge from cervix, acuminate condylomata on vulva or cervix, loss of mobility in the uterus, palpable enlargement of appendages, and signs of perimetritic or parametritic exudation. It must not be forgotten that after recent delivery the vulva and vagina may show a condition of hyperæmia and catarrh, which closely simulates some of the appearances just described. Eversion at the meatus urinarius is also seen when the anterior vaginal wall is prolapsed.

Diagnosis is greatly facilitated in the case of a sensitive, shrinking patient with rigid abdominal walls by a thorough examination under anæsthesia, in the "lithotomy" position, with a good light. At the same time, if indicated, follicles can be destroyed, eroded patches cauterised, and minor measures carried out; and a good opportunity is afforded for taking pus from the gland ducts and follicles for examination for gonococci.

Bacteriological diagnosis.—The examination of a stained film under a $\frac{1}{12}$th oil-immersion objective with a condenser is a clinical method which should be employed as a routine in gynæcological wards. The preparation of the film is well within the compass of a careful clinical clerk; the results are often conclusive. Sometimes they are inconclusive, and in important and doubtful cases the opinion of an expert is necessary.

Directions for the bacteriological examination for Gonococci.—Take a drop of pus on a sterilised platinum wire from the urethra or from one of the periurethral follicles, or ducts of Bartholin, or from the cervix through a cylindrical speculum. Gonococci may be found in the urethra and cervix, even though the secretion be clear. Make thin smears on two or more glass slips; a series of these should be kept ready in a jar of spirit, and it is useful to number them previously with figures written on the glass with a diamond. Cover glasses may be used for films, but glass slips are more easily handled and identified. Dry the film over a spirit lamp or Bunsen's burner. The film can be stained with a watery solution of an aniline dye, such as Löffler's methylene blue or fuchsin. The following solution has the great advantage of staining the bacteria red and the nuclei greenish blue, and so of facilitating the recognition of the micro-organism.

Carbol-Pyronin-methyl Green (Pappenheim)

Formula.—	Methyl green	·15 grm.
	Pyronin	·25 ,,
	Alcohol	2·5 c.c.
	Glycerin	20 ,,
	2 per cent Phenol in water .	100 ,,

Stain from two to four minutes.

Wash the colour away with water, dry with blotting-paper and spirit lamp. Examine at once by placing drop of oil on film, or else mount in Canada balsam with a cover glass. A second film is to be examined by Gram's method for comparison with the first, in the following manner:—

1. Stain in aniline oil-gentian violet, or in carbol-gentian violet, for about five minutes, and wash in water.
2. Treat the film with Gram's solution till its colour becomes a purplish black. Generally about one-half to one minute is sufficient for the action to take place.
3. Decolorise with absolute alcohol till no more colour comes away, and only a faint violet tint remains.
4. Wash in water, stain in ·2 per cent watery vesuvin five minutes, wash, dry, and mount.

Recognition of the Gonococcus.—Gonococci are recognised first by their characteristic shape and appearance as already described.

Secondly, by their relation to the pus cells or leucocytes. They are found singly or in groups within the protoplasm of the cell, or close to and upon the cells. The gonococci thus seek the cells and penetrate them, and do not lie indifferently amongst and between them.

Thirdly, they do not retain their stain when treated by Gram's method.

When these three points are clearly established we have a positive result with very slight limit of error, which when confirmed by clinical evidence yields a practically certain diagnosis. Many films, however, give a doubtful result. Gonococci are not always of typical shape, and in the presence of a number of other organisms it may not be possible even for an expert to be certain. When a *negative* result is obtained repeated examination must be made. Gonococci may be present at or just after the menstrual period and not at other times; or an irritant injection may make them appear when not previously visible.

The consequences, social and medico-legal, of a diagnosis of gonorrhœa are so peculiarly serious, that it is extremely important not to stake too much on the presence of a few diplococci of not very typical appearance. Practical gynæcologists to-day recognise freely the great assistance which bacteriological diagnosis gives them, but feel the need of caution in this matter, especially as the views of bacteriologists have not yet reached unanimity and finality. See remarks on this point by Herman (17); and also by Garrigues (13), who gives some examples of the mistakes which may be made.

Cultivation of the Gonococcus.—A good and serviceable method of making pure cultures of the gonococcus for clinical work is a great desideratum. Up to now this has been wanting, and bacteriological experts speak of the difficulty of cultivating this particular micro-organism. Wertheim used human blood serum mixed with pepton-agar. The fluid from ovarian or other cysts, from ascites, or from hydrothorax, has been used, and also albuminous urine. Wasserman employed a medium consisting of swine serum, "nutrose," and pepton-agar (54). Attention may, however, be drawn here to a recent paper by Lipschütz (24). He has used with great success an alkaline 2 per cent solution of egg-albumen, employing for its preparation "finely powdered egg-albumen" as sold by Merck (*Albumen aus Eien pulv. subt.*). This has the advantage of being always obtainable and readily soluble in water, and also of supplying the albuminous element which seems necessary for the culture of the gonococcus. It is filtered and sterilised, and mixed with two or three parts of pepton-agar or ordinary bouillon. Thus is produced "albumen-agar" or "albumen-bouillon," and in this Lipschütz has cultivated the gonococcus to the thirty-fifth generation.[1]

Treatment.—*Prophylaxis.*—Gonorrhœa is a preventible disease, but the problem of its prevention brings us face to face with the most difficult of all social problems. Directly or indirectly every case is due to *prostitution*. The discussion of this question lies beyond the scope of this article.

A more hopeful question is, What can be done to hinder men with uncured disease from marrying? While some are beyond the reach of any appeal to higher considerations, the majority of such men marry only believing themselves to be cured; and if they knew that they were almost certain to convey infection, and fully realised the risk of injury and suffering to which their wives would be exposed, they would suffer almost anything rather than wrong them so grievously. It is of prime importance that gonorrhœa should be regarded more seriously by our patients and by ourselves as a profession. A clear statement must be made of the danger of the chronic stages; treatment must not be discontinued as soon as the subjective symptoms are over, but must be persisted in till the disease is cured, the cure being confirmed by bacteriological investigations.[1]

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[1] The writer is indebted to Dr. S. Geoffrey Scott for assistance in preparing this section.

Aseptic gynæcology.—We take it for granted that now in gynæcological practice all instruments are sterilised systematically, not less in the out-patient department than in the operating theatre. It is superfluous to go into details. The old Fergusson's speculum of glass covered with lacquer is now obsolete. It cannot be boiled, is usually chipped or cracked, and is a most dangerous germ-trap. The routine use of the sound is greatly to be deprecated. Pessaries of all sorts are apt to help break down the asepticity of the genital canal. They are to some extent a necessary aid, but all possible precaution must be taken to prevent harm from them. I have already mentioned the risk of infecting the rectum from the vagina. Sterilised finger-stalls are very useful for rectal examinations. I may also point out the importance of negativing the presence of gonorrhœal infection before such an irritative foreign body as a pessary is placed in the vagina.

Therapeusis.—There is no specific for gonorrhœa. Recovery is brought about by the natural reaction of the tissues. Our aim must be to remove all that hinders recovery, and to promote the general health. At the same time, because of the superficial seat of much of the morbid process local treatment is useful within certain limits.

The first indication is to forbid coitus. Next, it cannot be too plainly said that in an infected pair both spouses must be cured. It is, for instance, absolutely futile to hope for a cure in the wife if she receives fresh infection from the original source. Thirdly, special emphasis must be laid upon the necessity for *rest*, particularly in early and acute stages, and at the menstrual period. In a case of recent infection the patient may well be kept entirely in bed for two months. The fulfilment of the above indications, together with relief from the strain and worry of domestic responsibilities, are often best secured by removing the patient to a nursing home or hospital; remembering also that fresh air, open air, and sunshine are valuable adjuvants.

In acute stages, when there are pain and pyrexia, or at times when acute abdominal symptoms threaten, low diet is indicated; but in the majority of cases, which are chronic, a generous diet with tonics is required. Care must be taken to prevent constipation and the accumulation of hardened fæcal masses in the rectum. At all stages alcohol is best avoided. The progress of treatment must be checked by bacteriological investigation.

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[1] Neisser's own directions for ascertaining whether a man is free from infection are as follows (33):—

1. Very frequent examination must be made during several weeks of the secretion from the anterior and posterior part of the urethra and from the prostate, and if possible from the vesiculæ seminales.

2. Artificial stimulation of the secretion of the urethra must be made mechanically by the catheter, or chemically by the injection of some irritant.

3. The secretion of the mucous membrane of the urethra and its recesses must be mechanically squeezed out with a bulbed sound. The urinary sediment must be centrifuged and the smallest threads and filaments examined.

If no gonococci are then found we cannot forbid a man to marry, even though a small amount of catarrhal discharge remains. This statement has been traversed by Kromayer. It is not absolutely accurate, but the percentage of error is very small. The last remaining gleet often cannot be eradicated although no longer virulent. To make the cessation of this a *sine qua non* would be impracticable.

There is a very general consensus of opinion that in the acute stage active treatment should be avoided. The question naturally arises whether by treating the genital tract vigorously at once with powerful germicidal agents the attack might be cut short. This does more harm than good. In such a complicated mucous tract *all* the cocci cannot be reached, and those which are not destroyed multiply all the faster because of the inflammatory reaction set up by the caustics; moreover, the passage of sounds, Playfair's probes, tents, and other dilators, or the use of intra-uterine injections, all tend to cause "ascension." The curette has in some quarters been employed almost indiscriminately in uterine disease, especially on any suggestion of endometritis or menorrhagia. In acute or subacute gonorrhœa it is a dangerous and inefficient agent, and even in chronic gonorrhœal endometritis it is only exceptionally indicated. The curette is a very poor weapon with which to make war on micro-organisms. Within the last two years Professor Bumm in summing up his views on the whole question has specially emphasised this point (8). See also a paper by G. Klein already referred to (22). Thus if a recently married woman complains of dysmenorrhœa and menstrual excess, one must not proceed to dilatation and curetting without carefully excluding the possibility of the case being gonorrhœal. The curette is used, we notice, in acute gonorrhœa by some American gynæcologists, but is emphatically condemned by others (48).

Use of Drugs.—Balsams, such as copaiba and cubebs, have no specific action. The urine of a man who was taking copaiba has been found not to affect gonococci at all (Steinschneider, 50).[1] Yet it does not follow that they are useless; they help to check catarrhal discharge, and have been found of benefit for urethral and vesical symptoms.

Local Applications.—Compounds of silver play a special part in the treatment of gonorrhœa. Their use in ophthalmia neonatorum is well known. Of late years various organic compounds of silver have come into use which are less irritating than the nitrate, and penetrate more deeply, because they do not coagulate albumen, and because the silver is not precipitated as chloride in the tissues.

Argentamine is now largely used in Germany. It corresponds in strength to a 10 per cent solution of the nitrate. *Argonin* contains less than 8 per cent of silver, *protargol* 8 per cent, *largin* 11·1 per cent, and *argyrol* (Vitellin) 30 per cent. Special attention has lately been drawn to argyrol by the American medical press. It was discovered by A. L. Baines in 1902. It is very soluble, painless, and unirritating; and it is described by Pedersen of New York (39) as being

[1] Recently germicidal action has been observed in the urine of patients taking *gonosan* (sandal-wood oil and kava-kava resin). See *Practitioner*, November 1905, p. 717; and E. Runge, *Münch. med. Wochensch.* January 31, 1905.

widely accepted as the best anti-gonorrhœal drug known to-day, and its introduction is said to be a most important advance in the treatment of this disease. It is used in male gonorrhœa for injection into the urethra, and is employed early in the disease, *i.e.* in the first week; Christian (9), speaking from the experience of upwards of 2000 cases, states that it destroys the gonococci, lessens the discharge, and shortens the course of the disease better than any other remedy. Purdy gives a most satisfactory account of its trial at the London Lock Hospital (40). American gynæcologists have used it with success in gonorrhœal affections in women (Christian, 9), and they are using it in the early acute stages, injecting, for instance, 20 per cent solutions into the cervix. Argyrol has the disadvantage of being costly, also it stains linen black but the stains wash out.

Vaginal irrigation with medicated solutions is the first remedy that suggests itself for dealing with purulent leucorrhœa, and probably every antiseptic and astringent in official and extra-official pharmacy has been used in turn for gonorrhœal discharge. Experience has shown that if at all irritating in nature they make gonorrhœal inflammation worse, and that the use of injections in acute stages favours ascension. Some would discard them altogether, treating the vagina by swabbing it out with cotton-wool pledgets on suitable holders. This requires skilled attendance at each application. We believe that when the subacute stage is reached vaginal irrigation is useful, provided that there is good provision for a return current, that the douche reservoir is raised only just sufficient to make the water flow, and that the agent used is well diluted.

Permanganate of potassium in pale claret-coloured solution, biniodide of mercury (1 in 3000), carbolic acid (1 per cent), sulpho-carbolate of zinc (1 per cent), or boric acid (saturated solution), are examples. A douche of plain warm water may precede the medicated douche.

Some interesting observations have been made lately on the effects of *yeast* in destroying micro-organisms, such as gonococcus, streptococcus and staphylococcus, the gonococcus being most quickly destroyed. Otto Abraham (1) has obtained good results in chronic cervical gonorrhœa, using cervical bougies which contain yeast with asparagin as nutrient medium—for yeast requires sugar for its action. These are called rheol-bougies. These must not be used in acute cervicitis, but for gonorrhœal vaginitis, however acute, yeast can be used. There is no danger of causing ascension; and it is asserted that gonococci and discharge soon disappear, and that even cervical infection is thus removed. A. Martin of Greifswald has also used sterilised yeast in the gonorrhœa of pregnant women with good effect (27).

In subacute and chronic gonorrhœa our aim is (says Jadassohn) to destroy the gonococci at all points where they exist, with the least possible injury to the mucous membrane; to try to subdue inflammation and avoid all harmful influences.

Turning now to the local treatment of special parts, the following points are of importance in addition to what has been already said. In all cases where there is copious discharge the external genitals require cleanliness and disinfection. The pubic and vulval hair should be removed, and the parts must be carefully bathed with some weak antiseptic lotion (biniodide of mercury, 1 in 3000). When there is erythema or pruritus, lead lotion is useful, and boric acid ointment with addition of liquor carbonis detergens (ʒi. in ℥i.). An ointment of menthol and vaseline (1 in 10) is useful for pruritus. Hot sitz baths and continued fomentations with boric wool may be used for relief of pain.

In Vulvo-Vaginitis of Children.—Rest, strict cleanliness, baths, and applications of weak antiseptic lotions to vulva, are all that is required in acute stages. Later a 3-5 per cent solution of argyrol may be applied to the vagina with a camel's hair brush, or small bougies of iodoform and cacao butter may be inserted (Runge). Care must be taken to destroy and remove the infected dressings, and the danger of infecting the eyes must be guarded against. Bumm saw symptoms of acute peritonitis follow an injection of silver solution into a child's vagina.

In the *vulvitis and vaginitis of adults*, when the acute stage is subsiding, vaginal irrigation with permanganate of potassium may be commenced, and medicated vaginal suppositories of eucalyptus or iodoform, and tampons of glycerine and ichthyol (10 per cent) may be used. In the more chronic stages, when the disease is confined to isolated tracts of the mucous membrane, the vagina must be carefully examined by speculum, and the granular spots touched with pure carbolic acid or nitrate of silver; the small follicles may be destroyed with the fine cautery point. The examination must be repeated in a week, and again as required.

Gonorrhœal urethritis is treated on the same lines as in the male. In the acute stages injections are not advised, except by the advocates of argyrol. In subacute stages urethral irrigation with permanganate of potassium is advised. In the more chronic cases, where the discharge is of the nature of a gleet, the silver preparations administered by injection and by means of metal bougies smeared with glycerine and argyrol (10 to 20 per cent) are especially useful.

In the most chronic cases, with chronic irritability of the bladder and limited lesions, but yet perhaps pus in the periurethral follicles, it may be necessary to dilate the urethra and to explore it with the urethral speculum; local applications may then be made to granular patches and the follicles can be destroyed.

For gonorrhœal cystitis, irrigation of the bladder with weak solution of a silver salt is recommended, such as nitrate of silver 1 per cent.

Inflammation of Bartholin's glands is treated by fomentation, lead lotion, etc., but when cystic distension or suppuration occurs radical surgical measures are indicated.

In *acute cervical gonorrhœa* local treatment is not advised. Vaginal irrigation is the utmost that should be allowed. *Chronic cervical gonorrhœa* is a condition frequently presented to the gynæcologist for treatment, and there is often no doubt that the infection has been in existence for months or years. Bearing well in mind the danger of causing ascension, treatment is commenced by exposing the cervix, wiping out the glairy mucus from the canal, and then swabbing the cervical mucous membrane with such an application as 20 per cent argyrol. If there be a granular erosion on the lips of the cervix this must be destroyed to start with, and nitric acid is a very efficient agent for the purpose. If there be distended follicles these must be punctured, and for this purpose the galvano-cautery point may be used. The swabbing of the cervix must be repeated three times weekly, the patient being kept in bed. Antiseptic vaginal irrigation may be combined with this. After six applications treatment is suspended to watch the result and make bacteriological examination.

In *chronic gonorrhœa of the corpus*, even more than of the cervix, confinement to bed is necessary; ambulatory therapeusis is no good. Here also we must rely upon repeated applications rather than heroic measures on a single occasion. Begin with weak applications, and watch carefully for signs of inflammatory reaction. Probably the best application is an organic silver compound made with a Playfair's probe charged with cotton wool; for instance 5 per cent to 10 per cent argyrol may be used to begin with. Sometimes the cervix may need dilating, the vagina and cervix being first carefully disinfected. Amongst many applications that have been advised may be mentioned protargol, ichthyol, carbolic acid, iodised phenol, iodine, formalin, acetate of alumina, and other astringents. Iodised phenol, *i.e.* iodine and carbolic acid, is for the more chronic cases when other measures have failed. It is only in chronic cases with much menorrhagia that I recommend curetting, preceded by dilatation to 12 or 15 mm., and followed immediately by thorough applications of pure carbolic acid or 20 per cent argyrol.

In the case of *salpingitis*, *ovaritis*, and *peritonitis*, our choice lies between long rest, with fomentations, hot douches, glycerine and ichthyol tampons, counter-irritation, general medical treatment, with infinite patience on the one hand, and surgical treatment with extirpation of the affected parts on the other. There has been a reaction lately against systematic employment of the knife. Fritsch says that expectant treatment should be carried on for at least six months before operation is thought of. Krönig tells of thirty-eight women with gonorrhœal adnexitis of whom thirty-two became well able to work without operative treatment (49). Gonorrhœal inflammation is not essentially incurable. Gonorrhœal arthritis, for example, yields to time and treatment, and epididymitis is not considered to call for castration. For some cases, however, there is nothing but extirpation, and when both ovaries and both tubes are removed for gonorrhœal disease it is a good plan to remove the uterine body also.

Gonorrhœa of the rectum requires treatment by simple measures, such as injections of permanganate of potassium, or boric acid, or a moderate amount of some silver preparation. Very alarming collapse may follow a rectal injection of a weak solution of carbolic acid in small amount. A chronic case might require careful examination by speculum, with search for fissures or granular patches, or small submucous sinuses, which should be treated by caustic, or incision and caustic, as required.

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PELVIC HÆMATOCELE

Definition.—A pelvic hæmatocele may be defined as a tumour, usually encysted, formed by an extravasation of blood into the peritoneal cavity, or into the cellular tissue of the pelvis, and owing its origin to some disease of the pelvic organs. Two varieties can be distinguished, viz. the intraperitoneal and extraperitoneal forms. To the latter the name "pelvic hæmatoma" is given by some writers, but as this term is generally applied to the effusions of blood which occur into the pelvic cellular tissue near the vulva below the vaginal attachment of the pelvic fascia, it is better to limit its use to this condition; especially as the pathology and causation of such a tumour are quite different from those of the effusions of blood to be considered in this article.

The term pelvic hæmatocele should not be applied to a quantity of blood lying free in the peritoneal cavity due to the rupture of a tubal gestation, as in such a case a definite tumour is rarely formed.

Hæmatoceles may be further distinguished by their anatomical relation to the uterus, as retro-uterine, peri-uterine, or supra-uterine, and from their relation to the tube as peritubal or paratubal. It is now recognised that a hæmatocele need not of necessity occupy the pouch of Douglas, and that other varieties besides the classical retro-uterine form are met with.

Ætiology.—Our knowledge of the ætiology of pelvic hæmatocele is much more perfect at the present time than it was but a few years ago. The number of cases in which the cause is undoubtedly an extra-uterine gestation is so large that many writers are inclined to doubt the possibility of any other condition giving rise to these tumours;

but when we take into account the extreme vascularity of the pelvic organs during menstruation and pregnancy, it is not surprising to find that hæmorrhages may occur into and around them from comparatively slight causes.

Cases of pelvic hæmatocele may be divided, as regards their causation, into two main groups, viz. those due to ectopic gestation and those due to other conditions. The figures published by Dr. Cullingworth show that the great majority of these tumours originate in the rupture of a tubal gestation, or, more commonly still, in a tubal abortion. In twenty-five cases of pelvic hæmatocele in which the source of the bleeding could be verified, he found twenty-four due to tubal pregnancy; the remaining case resulting from the rupture of a broad ligament cyst was associated, curiously enough, with a tubal gestation.

Fritsch has never seen a case of hæmatocele in which the presence of a tubal pregnancy could be excluded with absolute certainty, and considers this the only possible cause; Schauta has observed the condition only as the result of tubal abortion. According to Fehling, the cause is tubal pregnancy in as many as 90 to 95 per cent of all the cases. The figures which tend to prove the opposite, such as those of Oberer, who in fifty-nine cases found only three which could be attributed to tubal gestation, and those of Weiss and Spengler, who found such a cause, the former once in seventeen cases and the latter only six times in fifty cases, must be accepted with much caution, as in many of these cases no confirmation of the diagnosis was obtained by post-mortem examination or by operation, and a certain diagnosis can only be made by one or other of these means.

Although a tubal abortion most commonly gives rise to a pelvic hæmatocele, yet it may have as a sequel the formation of a free intraperitoneal hæmorrhage; thus in nineteen cases of tubal abortion Cullingworth found that two resulted in a free effusion of blood into the peritoneum, and the remaining seventeen in a pelvic hæmatocele. Among nine cases of tubal rupture, on the other hand, no less than seven gave rise to a free intraperitoneal effusion, one to a pelvic hæmatocele, and one to a pelvic hæmatoma. Out of twenty-one cases of intraperitoneal hæmorrhage due to tubal pregnancy (in which the condition of the tube was carefully noted), Prof. Taylor found that fourteen were due to hæmorrhage from the unruptured tube, while seven were associated with rupture of the tube. Döderlein reports thirty-four cases operated upon by him, of which twenty-seven were examples of tubal abortion with intraperitoneal hæmatocele, and four were cases of tubal rupture and diffuse intraperitoneal bleeding.

The view that many cases of pelvic hæmatocele owe their origin to reflux of blood along the Fallopian tubes during menstruation (or to hæmorrhage from the tubes in cases of uterine abortion) is difficult to accept, and yet some of the recorded cases render it impossible to deny that such a thing may occur. This explanation was first put forward by Fénerly at a time when less was known about the frequency of cases of tubal gestation, and it formed the subject of much controversy. Even at the present day we find that opinions diverge very widely upon the matter; thus while the possibility of tubal menstruation is denied by Strassmann, it is considered as proved by von Herff, and regarded as doubtful by Schonheimer. That in the recorded cases the tubal mucous membrane was by no means healthy must be remembered. In the case published by Hofmeier, for example, periodical monthly hæmorrhages occurred from the mouth of the Fallopian tube which had been fixed in the lower angle of the abdominal wound after an operation for an extrauterine gestation.

In the cases of Haeckel and von Herff tubo-abdominal fistulæ resulted from a puerperal abscess, and hæmorrhage took place from them at each monthly period. Thorn reports the case of a woman, thirty-seven years of age, who was found to have an abdominal fistula three years after the enucleation of a myoma from the anterior wall of the uterus; blood commenced to flow from the opening eleven months after the operation, and continued to do so for twenty-five months. The observations of Leopold and von Winckel have demonstrated that at each monthly period the Fallopian tubes become congested and hæmorrhages occur into their tissues; but there is no escape of blood from the abdominal ostium in any way similar to that which takes place from the uterine os externum. No proof has so far been produced that menstruation can take place from the mucous membrane of the healthy tube; but that bleeding can occur from a diseased tube there is no reason to doubt; indeed, this is proved by the record of its occurrence in cases of atresia of the vagina, of tubo-abdominal and tubo-vaginal fistulæ; and if we accept this fact we must admit that such a tube may give rise on occasions to hæmorrhage into the peritoneal cavity, and so lead to the formation of a pelvic hæmatocele.

Cases of so-called "metrorrhagic hæmatocele," or instances of uterine hæmorrhage, with the simultaneous escape of blood from the Fallopian tube into the peritoneum, are no doubt to be explained as examples of tubal pregnancy with intraperitoneal bleeding from the abdominal end of the tube, or as cases of bleeding from a diseased tube.

Cases of hæmorrhage from the tube in chronic salpingitis, where tubal pregnancy could be absolutely excluded, have been recorded by Fehling, Sänger, and Thorn, and this is not surprising when we remember how extremely vascular the tube often is in such cases. Pozzi mentions the possibility of hæmorrhage from the open end of the tube in salpingitis, while hæmorrhage into a hydrosalpinx is not uncommon, and in the event of the rupture of such a tumour the formation of an intraperitoneal hæmorrhage is easy to understand. Such a case has been recorded by Martin. Gardner has described an hæmatocele due to the rupture of a tuberculous Fallopian tube which had become distended with blood.

In Bernutz's account of this condition several cases are recorded in which the cause is supposed to have been a rupture of the ovary. In the light of our more extended knowledge, many of these, if not all of them, were no doubt examples of ruptured tubal or ovarian gestation. The question as to whether cases are ever met with in which the source of the hæmorrhage is the ovary, as, for example, from the rupture of an excessively vascular Graafian follicle, is one that still admits of discussion. Gabriel has, however, collected a sufficient number of cases from the literature to show that such hæmorrhage can and does occur, and has himself recorded a striking example of this kind. The patient, a woman twenty-four years of age, was operated upon and was found to have a retro-uterine hæmatocele due to bleeding from the rupture of a Graafian follicle. The presence of ovarian pregnancy was excluded. Neumann and Scanzoni have recorded cases of severe intraperitoneal hæmorrhage arising from the ovary, and Bender and Marcille have recently met with a case of severe intraperitoneal hæmorrhage requiring laparotomy which was due apparently to the rupture of a small hæmorrhagic cyst of the left ovary. The right appendages and the left tube were normal, and histological examination failed to show any evidence of pregnancy in the wall of the cyst.

The rupture of an ovarian cyst is not uncommonly followed by the occurrence of hæmorrhage into the peritoneum, but the importance of the primary condition far outweighs that of the complication. Gardner has met with the case of a patient in whom the presence of an adeno-carcinoma of the ovary gave rise to an intraperitoneal hæmorrhage. Other malignant tumours may also cause bleeding into the peritoneum; for example, Fritsch recorded a case of sarcoma of the connective tissue of the pelvis associated with a hæmatocele the size of a child's head.

In attempting to determine the cause of an obscure case of pelvic hæmatocele, the possibility of hæmorrhage from the rupture of adhesions containing blood-vessels must be borne in mind. Such tearing may take place during the replacement of an adherent retroverted uterus, in a rough bimanual examination, or during a strong straining effort on the part of the patient. Even where no definite adhesions exist the peritoneum in pelvic peritonitis is often very vascular, and from such a membrane bleeding may occur in a manner analogous to that met with in cases of hæmorrhagic meningitis.

The influence of such general diseases as purpura and hemophilia, and of the acute specific fevers in producing congestion of the pelvic organs, is well known, and cases of scarlet fever, measles, and small-pox are recorded in which the pelvis has contained a considerable quantity of blood. A similar condition has also been seen in cases of acute yellow atrophy of the liver, phosphorus poisoning, and yellow fever. Sauter has published cases, confirmed by post-mortem examination, of intraperitoneal hæmorrhage in patients the subjects of heart, lung, and kidney disease, and Freund has seen this condition in a patient with a fatty heart, and in a case of double pneumonia. Phillips has met with a similar case in connection with acute rheumatism, which he regarded as "cachectic" in origin. Many such cases are to be found in the writings of Trousseau, Bernutz, and Goupil, the latter distinguishing them as symptomatic hæmatoceles.

Amongst these writers, intraperitoneal or extraperitoneal hæmorrhage from the bursting of a varicose vein of the broad ligament was regarded as a common cause of a hæmatocele, but such an occurrence must be of great rarity and, indeed, its possibility is very doubtful. In such cases as are not due to an extraperitoneal gestation, the coincidence of the onset of the attack of bleeding with a menstrual period appears to be more than fortuitous. It is possible that in these cases degenerative changes in the vessels may predispose to hæmorrhage. In women who have borne a number of children marked dilatation of the pelvic veins, varicosities, and the presence of phleboliths have been noted by Klob. The combination of such changes with conditions leading to pelvic congestion, viz. heart or lung disease, may lead to the rupture of vessels and intraperitoneal hæmorrhage. Cullingworth has recorded a case where the rupture of a varicose vein inside the Fallopian tube led to the formation of a tubal hæmatocele, and yet the absence of a tubal pregnancy seemed proved. Amongst other possible causes requiring mention are rupture of the uterus or rupture of the vagina, which often leads to the formation of a large intraperitoneal and extraperitoneal hæmatocele; injuries inflicted upon the genitalia during coitus, during operations, or by the introduction of foreign bodies; and the slipping of a ligature after an abdominal section. Olshausen has recorded a very curious case in which a woman wearing a Zwancke's pessary developed a hæmatocele three years in succession.

The immediate cause of a hæmatocele is not infrequently a fall, a blow, or some straining effort on the part of the patient, while in a large number of cases the rupture of an extra-uterine gestation has followed sexual intercourse.

Frequency.—A pelvic hæmatocele is somewhat more common in multiparæ than in nulliparæ, and is most likely to occur during the child-bearing period of life. Thorn has, however, seen a case in a virgin sixteen years of age. The exact frequency of the condition cannot be determined with accuracy because of the difficulty of correct diagnosis, except in cases operated upon or terminating fatally. Recent statistics of such cases are the only ones which can be relied upon for this purpose. Thorn estimates that intraperitoneal hæmatoceles occur in the proportion of 0·9 per cent, and extraperitoneal hæmatoceles in the proportion of 0·1 per cent to 0·2 per cent of all cases of diseases peculiar to women. Adding together all the figures quoted by Winternitz, we have a grand total of 27,842 cases of diseases of women, amongst which there occurred 312 cases of hæmatocele, or a proportion of 1·1 per cent. No doubt these figures give a very fair estimate of the frequency of this disease in ordinary hospital practice.

Pathology.—Schroeder and some of the older writers thought that closing of the pouch of Douglas by adhesions was necessary before a pelvic hæmatocele could be formed, the adhesions serving to limit the effusion of blood. Recent investigations and the knowledge we have gained from abdominal sections and post-mortem examinations have shown us that, so far from this being the case, the peritonitis usually follows the effusion, and the bleeding sets up an inflammatory exudation which leads to the shutting in of the blood and the formation of a palpable tumour.

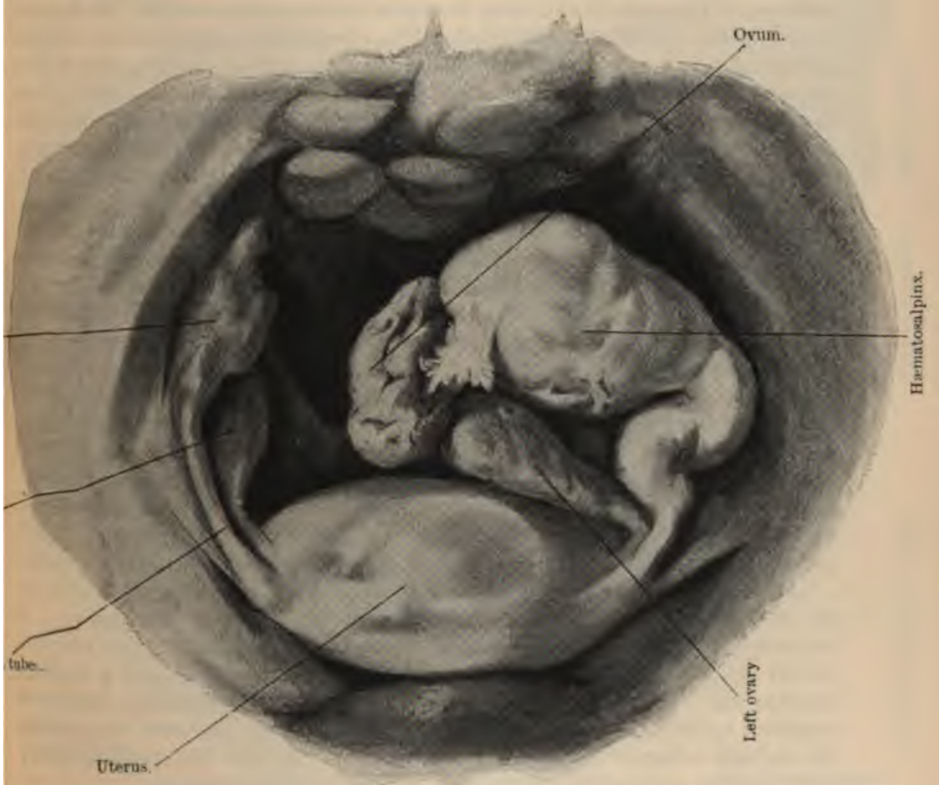


FIG. 140.—Complete tubal abortion with a hæmatosalpinx and peritubal hæmatocele. (From Bumm.)

Pelvic hæmatoceles can form without the previous occurrence of peritonitis, but when the peritoneum has been or is inflamed, the blood clots more rapidly, and forms a definite tumour at an earlier date, than in those cases where the serous membrane is quite healthy. The presence of changes in the peritoneum due to an old attack of peritonitis also interferes with the absorption of the recently effused and still fluid blood, and if the adhesions are numerous and completely close in the pouch of Douglas, the resulting effusion will naturally be limited and small.

The manner in which the tumour forms when its cause is a tubal abortion is no doubt much as follows. The resemblance of events in the case of an intra-uterine mole and a tubal mole, the usual precursor of a tubal abortion, is very close. As the result of hæmorrhage into the chorio-decidual space, or at times into the space between the chorion and the amnion, the extravasated blood breaks through the early chorion, and the fœtus dies; a molar pregnancy results, as in the uterus, or the ovum becomes converted into a mere mass of clot and débris. The presence of the mole in the tube, to which it commonly remains attached at one point, although occasionally it is completely extruded into the peritoneal cavity, sets up further intratubal hæmorrhage, and in time the amount of effused blood is too great to be contained in the tube; it then commences to escape little by little from the abdominal ostium, which, as a rule, remains patent for the first eight weeks or so of a tubal gestation. The escaping blood coagulates round the end of the tube, and as a result of the repeated hæmorrhages the tumour grows larger and larger, until at length the tube lies embedded in a rounded mass consisting of coagulated blood and forming a typical peritubal hæmatocele. As the result of further hæmorrhage, which tends to continue so long as the mole remains in the tube, the tumour grows larger and larger, the increase in size being permitted either by the rupture of the imperfectly formed capsule, which at first consists merely of the outer layer of coagulated blood, or by the stretching of this layer. In this way the tumour grows, until at last it fills up the posterior portion of the pelvic cavity more or less completely; and encroaches on the pouch of Douglas (Figs. 140 and 141). If the primary hæmorrhage is more severe, the escaping blood fills up the pouch of Douglas at once, forming a typical retro-uterine hæmatocele; or it may even cover over the uterus or fill the vesico-uterine pouch, forming a so-called supra- or ante-uterine hæmatocele.

In a typical case the uterus is pushed upward and forward against the abdominal wall and the symphysis pubis; in other instances it is pushed over to one side by a laterally placed tumour or lies retroverted below and behind the effused blood. The upper limit of a large hæmatocele is usually formed by coils of adherent intestine matted together, roofing over the tumour and shutting it in. Between the coils lie darkish-coloured masses of blood-clot and fibrin. The peritoneum, both visceral and parietal, usually shows signs of pigmentation.

As has been already stated, the hæmorrhage which occurs in the case of the rupture of a tubal pregnancy does not often give rise to a pelvic hæmatocele. In such cases the bleeding is usually too severe and too large in amount to allow of the blood becoming encysted, and not infrequently leads to the death of the patient, unless she is at once operated upon. On vaginal examination an indistinct, boggy mass can be felt in the pouch of Douglas, and abdominal examination may reveal the existence of free fluid; and on percussion in different postures the presence of slowly-shifting dulness in the flanks.

Sänger has divided hæmatoceles into the diffuse and the encysted or so-called "solitary" variety, and this classification has much to recommend it. By the diffuse variety he means that class of tumour which extends up into the abdominal cavity, the upper boundary of which is formed by coils of adherent intestine, while laterally it is bounded by the walls of the pelvis and of the abdomen. According to Sänger the blood-clot is traversed by strands of fibrous tissue containing capillary vessels, which often remain after the blood has become absorbed and form bundles of new connective tissue. The solitary or encysted hæmatocele forms a smaller tumour reaching but a short distance above the level of the plane of the pelvic brim, or is altogether confined to the true pelvis. It is frequently adherent to surrounding structures, especially to the intestine, and has a true capsule, the outer layers of which consist of a connective-

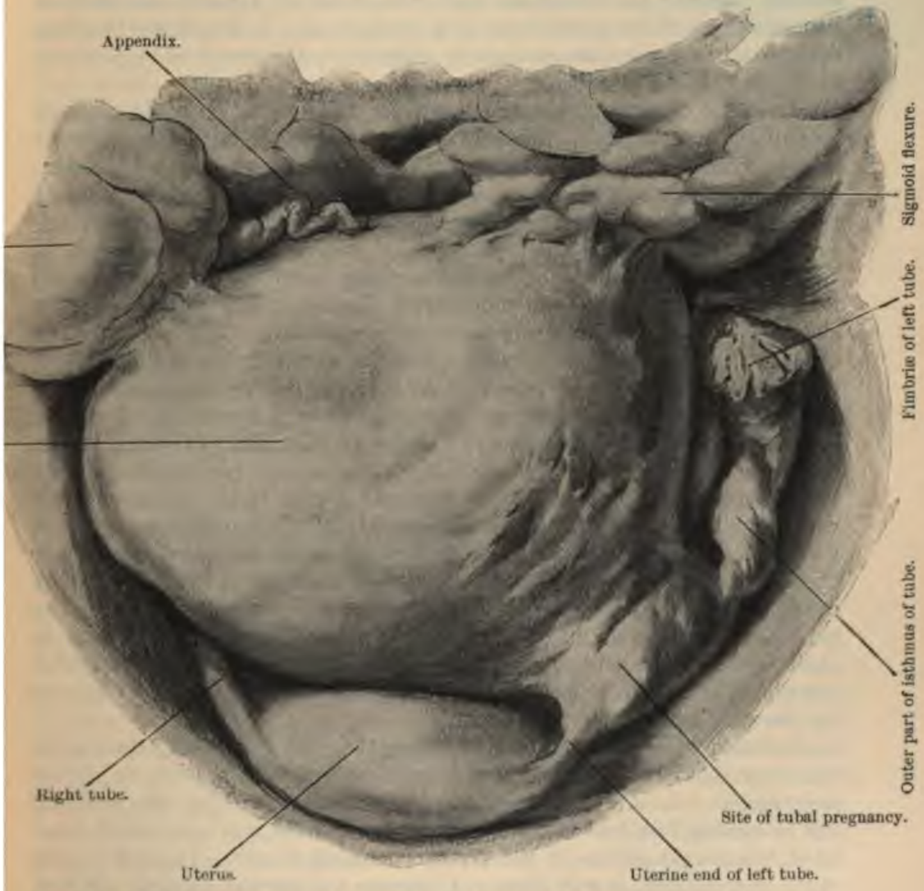


FIG. 141.—Retro-uterine hæmatocele resulting from the rupture of a tubal pregnancy in the isthmal portion of the tube. (After Bumm.) From an instantaneous photograph taken after separation of the intestines from the wall of the sac.

tissue basis and of organised fibrin. In cases where the capsule is especially well formed, it is often possible to shell out the tumour entire. On microscopical examination the capsule is found to consist of tissue elements closely resembling connective tissue and unstriped muscle tissue. Connective-tissue strands are not found, as a rule, in the blood-clot of the solitary hæmatocele. Schauta calls this kind of tumour a secondary hæmatocele, to distinguish it from a primary one, in which the bleeding occurs into a cavity surrounded by adhesions, the result of a previous attack of pelvic peritonitis.

In a case of extraperitoneal hæmorrhage the collection of blood may be situated in any part of the cellular tissue of the pelvis. It may form a tumour lying in the space between the vagina, the cervix, and the bladder; in the broad ligament either at its lower part or in the mesosalpinx; or in the cellular tissue at the upper part of the posterior vaginal wall.

The composition of the tumour itself will vary with the length of time which has elapsed since the hæmorrhage occurred. In recent cases it consists of fluid blood; in older cases the blood has clotted and the clots may have become decolourised and organised. At times only the outer part of the tumour is solid, while the central portion is composed of blood more or less altered and of a tarry, syrupy consistence. In some cases solidification occurs irregularly throughout the tumour. If suppuration has taken place, there will be an admixture of pus with the blood.

Progress.—The progress and course of a case of pelvic hæmatocele will vary to some extent with its causation. When due to a tubal gestation, it depends upon whether the case is one of tubal rupture or of tubal abortion, and whether the tubal abortion is complete or incomplete. When the ovum is extruded entirely into the cavity of the peritoneum the hæmorrhage tends to cease; but if it is still retained in the interior of the tube it sets up repeated hæmorrhages, attended with attacks of colicky pain and the signs of internal bleeding, and followed by the symptoms of pelvic peritonitis.

In cases where the bleeding is severe the entire effusion takes place in a very short time, although at first it may not be possible to detect any tumour. In a few hours, however, or in a few days, the swelling can be readily felt, and it may ultimately attain the size of a child's head or of the gravid uterus at the sixth or seventh month. In such a case, when once formed, it will often not increase any further in size. When, however, the source of the bleeding is a tubal abortion, the growth of the tumour is more gradual, and can be watched from day to day. The mass of blood, at first soft and semi-fluctuating, becomes harder and of unequal density, and the sense of fluctuation gradually disappears. These alterations arise from the changes in the blood-clot, the serum becoming absorbed, while the remaining clot becomes harder and harder in consistence.

The natural tendency is for the formidable symptoms to subside gradually. The effects of the shock are recovered from, the pain decreases, and after a time the patient suffers only from a feeling of great weakness, and from symptoms due to the presence of the mass in the pelvis, chronic in character, and more or less well marked in accordance with its weight and bulk. She experiences a sense of weight in the pelvis, bearing-down pains, difficulty in micturition and defæcation, and pain and discomfort on attempting to walk or to assume the sitting posture. If the tumour is situated laterally the vessels and nerves on that side of the pelvis may be pressed on and pain felt on movement. In all but the very severe cases, however, the tendency is for recovery to take place slowly, and for the blood to become absorbed. This does not apply to cases where the hæmatocele is associated with an extra-uterine gestation which is still developing; here the progress of the case is quite different, and is modified by the presence of the growing fœtus. In cases where the occurrence of the hæmatocele has resulted in the death of the ovum, as is usual, or when due to some other cause than an extra-uterine gestation, the natural tendency is undoubtedly towards gradual recovery, with the absorption of the effused blood. This holds good even in the case of the largest tumours, provided that the blood-mass is safely shut in by adhesions.

In twenty-five cases observed by Voisin, fifteen terminated by absorption. Dr. Champneys, out of a total of seventy-five cases under his care, found that in no less than thirty-five, *i.e.* 45 per cent, complete recovery took place without any surgical interference. The average duration of these cases is usually about four months. Braun, in twenty-four cases, noted complete absorption in six months, and Bandl's figures point to the same length of time as a fair average. In some instances the tumour diminishes in size very rapidly indeed; for example, in a case observed by Champneys the patient, on admission to the hospital, had a tumour reaching up to the umbilicus, and in three weeks it had diminished to such an extent that, together with the uterus, it was little larger than an orange of average size. In other cases it may be months before any definite change takes place. Zweifel records the case of a patient who lay in bed for a year without the tumour showing any appreciable decrease in size at the end of that time. In some instances where the patients are left without surgical interference, natural recovery not only takes place very slowly, but is subject to many interruptions. The functions of the pelvic organs may be impaired for months or years after the attack, with the physical signs of chronic peritonitis and chronic pelvic pain.

In a small proportion of cases the hæmatocele undergoes secondary rupture, and the patient exhibits all the symptoms of a severe internal hæmorrhage. In a few other cases suppuration takes place in the collection of blood, and the resulting abscess may burst into the peritoneum, or escape externally through the vagina, rectum, or bladder. Fortunately rupture into the peritoneal cavity, which is almost certainly followed by septic peritonitis, has always been rare and is still less likely to occur at the present day, when the first indication of suppuration would be followed at once by surgical interference. Of twenty-seven instances cited by Voisin, in six the abscess burst into the rectum, in three into the vagina, and in four into the peritoneum. Of Champneys' seventy-five cases, two discharged by the rectum. He considers that in cases due to an early extra-uterine pregnancy such a result entails no extra risk, although in more advanced cases, with the presence of fœtal bones and a non-collapsible sac, the danger is, of course, much greater. Bandl states that the most frequent mode of exit in spontaneous evacuation is by the rectum; if in such a case the sac becomes infected the patient may develop all the signs of chronic septic poisoning. Infection of an intraperitoneal hæmatocele no doubt takes place through the Fallopian tubes, the intestinal tract, or the bladder, and in some instances operative interference is responsible for this complication.

Apart from the rupture or the infection of the tumour, attacks of peritonitis may occur from time to time from comparatively slight causes. These may be mild or severe in character, and cases are mentioned by Voisin in which such an intercurrent attack ended fatally as late as three and four months after the date of the original hæmorrhage. In cases recorded by Cullingworth and others the remains of a hæmatocele have been found in the form of a cyst containing serous fluid.

In cases of extraperitoneal hæmatocele complete absorption of the blood-clot and the return of the parts to their normal condition is usually the final result. Of thirty-four cases observed by Thorn, in only one was an operation necessary; in the remainder recovery took place, in many so completely that no physical signs of the effusion could be detected, and the uterus regained its normal mobility. In a patient under my own care, with a history suggesting an ectopic gestation, on abdominal section a tumour about half the size of a fœtal head was found occupying the left broad ligament. It was covered by large veins, was of a softish consistence above and somewhat harder in its deeper portions. A diagnosis of a broad-ligament mole was made, and it was decided to close the abdomen and to incise the tumour by the vagina, if necessary, at a later date. Very severe hæmorrhage occurred from the tearing of one of the large veins, and a plug of iodoform gauze was introduced through the abdominal wound. The patient refused any further operation at that time, but the tumour, while she was under observation, diminished somewhat in size. Twenty months later she returned, with a small ventral hernia in the scar, and an operation was undertaken for its radical cure. On opening the abdomen no trace of the original tumour could be found, the left broad ligament was normal, and the uterus had its normal position and mobility.

Symptoms.—The symptoms produced by a hæmatocele depend to a large extent upon the rapidity with which the escape of blood occurs. In the so-called cataclysmic cases, due to the rupture of a tubal pregnancy, in which a true hæmatocele usually does not form, the hæmorrhage is often so profuse as to kill the patient before anything can be done, and the onset is very sudden and correspondingly alarming. A woman, previously quite healthy, who thinks that she is a few weeks pregnant, or who has missed one or two periods, is seized with a sudden attack of acute pain in the abdomen and all the signs of severe internal hæmorrhage. The attack of pain is followed or accompanied by intense pallor and utter prostration; the patient faints or complains of a feeling of great faintness; her mucous membranes are blanched, the pulse is very rapid, small, and thready, and the respirations are feeble, hurried, and shallow. There is a sense of impending death, and the extremities become cold and clammy. The temperature is subnormal, the expression is anxious and haggard, and the general condition of the patient critical. If the internal hæmorrhage continues, the severity of the symptoms increases, and the patient's condition becomes more and more serious; yawning, hiccough, and vomiting occur, the mucous membranes lose all their colour, great restlessness ensues, and fatal syncope ends the scene. The intellect is usually clear up to the very end. So rapid is the occurrence of death in some cases that the true state of things is not suspected. The suddenness of the onset and the severity of the attack not infrequently lead to the suspicion that the case is one of poisoning, or that perforation of one of the hollow viscera such as the stomach has taken place. Death may occur in a few hours, or in so short a time as twenty minutes, as in a case under my own observation. Fortunately, at the present day the life of these patients is often saved by the skill of the surgeon, and even apart from operation they occasionally rally and finally recover, with or without the cessation of the ectopic pregnancy. In cases where a less amount of blood is lost and a true hæmatocele forms, the symptoms, though of the same type, are naturally not so severe, and the condition of the patient not so critical. The acuteness of the attack is less marked in cases where the blood is poured out into the cellular tissue, than when it escapes into the peritoneum, for the double reason that less general disturbance is produced, and the effusion in these conditions is likely to take place more slowly and to be smaller in extent. In some instances the severity of the symptoms is quite out of proportion to the amount of blood lost.

In cases where a typical peritubal hæmatocele forms, paroxysmal attacks of pain occur, usually accompanied by the symptoms of more or less severe internal hæmorrhage and by hæmorrhage from the uterus. The attacks of pain are no doubt due to hæmorrhage occurring into the interior of the tube or into the peritoneal cavity. If the amount of blood effused is considerable, there is faintness, almost amounting to syncope, nausea and vomiting, and later the signs of pelvic peritonitis. The pain may be dull and continuous, or paroxysmal with recurring exacerbations; it is usually sudden in its onset, and at first very severe. A weight about the anus is often complained of, with frequent ineffectual attempts to empty the bowel, accompanied by tenesmus and the passage of mucus. After the tumour has developed, complete or partial retention of urine may occur. The patient lies upon her back with her thighs flexed, and there is usually some flatulent distension of the lower abdomen. A great deal of nervous disturbance is present with marked distress and restlessness, and at times shooting neuralgic pains in the lower limbs and elsewhere. Slight jaundice may be detected, no doubt hæmatogenous in character; and a dull white pallor, the result of the hæmorrhage, is often well marked and almost characteristic.

After the early severe symptoms are past, the patient may manifest those of pelvic peritonitis, with some elevation of temperature and a rapid pulse. In some cases the blood escapes so gradually that a typical peritubal hæmatocele may be found on examining the pelvis when the patient is seen for the first time; and as such a tumour may form with few or no symptoms, it may be impossible to determine the date on which the first attack of hæmorrhage took place.

Hæmorrhage from the uterus usually accompanies, or may follow, the internal bleeding. In most instances this is no doubt due to the partial or complete separation of the decidua from the interior of the uterus; in other cases it is a simple menorrhagia. The abdominal pain and the uterine hæmorrhage are almost constant symptoms. They were present in twenty-five out of thirty cases of pelvic hæmatocele observed by Dr. Cullingworth.

Physical signs.—If the extravasation is a large one, and yet not too large to become encysted, an abdominal tumour can soon be detected, situated either in the middle line or to one side of it, and extending down into the pelvic cavity. The time varies within which a definite tumour can be first noted. If the effusion has taken place into a cavity previously shut off by adhesions, it will be detected sooner than if the adhesions form secondarily. A swelling or fulness in Douglas's pouch may be felt within a few hours of the attack of bleeding, but a definite abdominal tumour usually not for a day or so. The tumour is extremely tender on palpation and difficult to examine; and its size is obscured by distension of the abdomen due to meteorism. It is at first elastic and semi-fluctuating, but becomes irregular and of varying consistence later, the firmness of its outline contrasting with the softness of the centre. The change in the consistence from that of a cyst to that of a solid, is almost pathognomonic of a hæmatocele. The hardness may be so marked that the tumour has been thought to be a fibromyoma of the uterus. It is dull to percussion, and may reach half way to, or even up to, the level of the umbilicus and down into the pelvic cavity, filling up the pouch of Douglas. The swelling is movable to some extent, and its upper border difficult to define, and often irregular in outline, extending higher on one side than on the other. On vaginal examination the tumour is felt pushing the uterus close up against the symphysis pubis and the anterior abdominal wall, distending the pouch of Douglas, filling the posterior half of the pelvis, stretching and pushing down the posterior wall of the vagina, pressing the rectum into the hollow of the sacrum, and often partially obliterating the lumen of the bowel. On bimanual examination it has a semi-elastic feel, and apparent spaces and nodular swellings can be felt in it, the former due to areas of uncoagulated blood and the latter possibly caused by the adherent uterine appendages. The elevated and anteposed position of the uterus, with the cervix situated close behind the symphysis pubis and at times almost inaccessible to the finger,

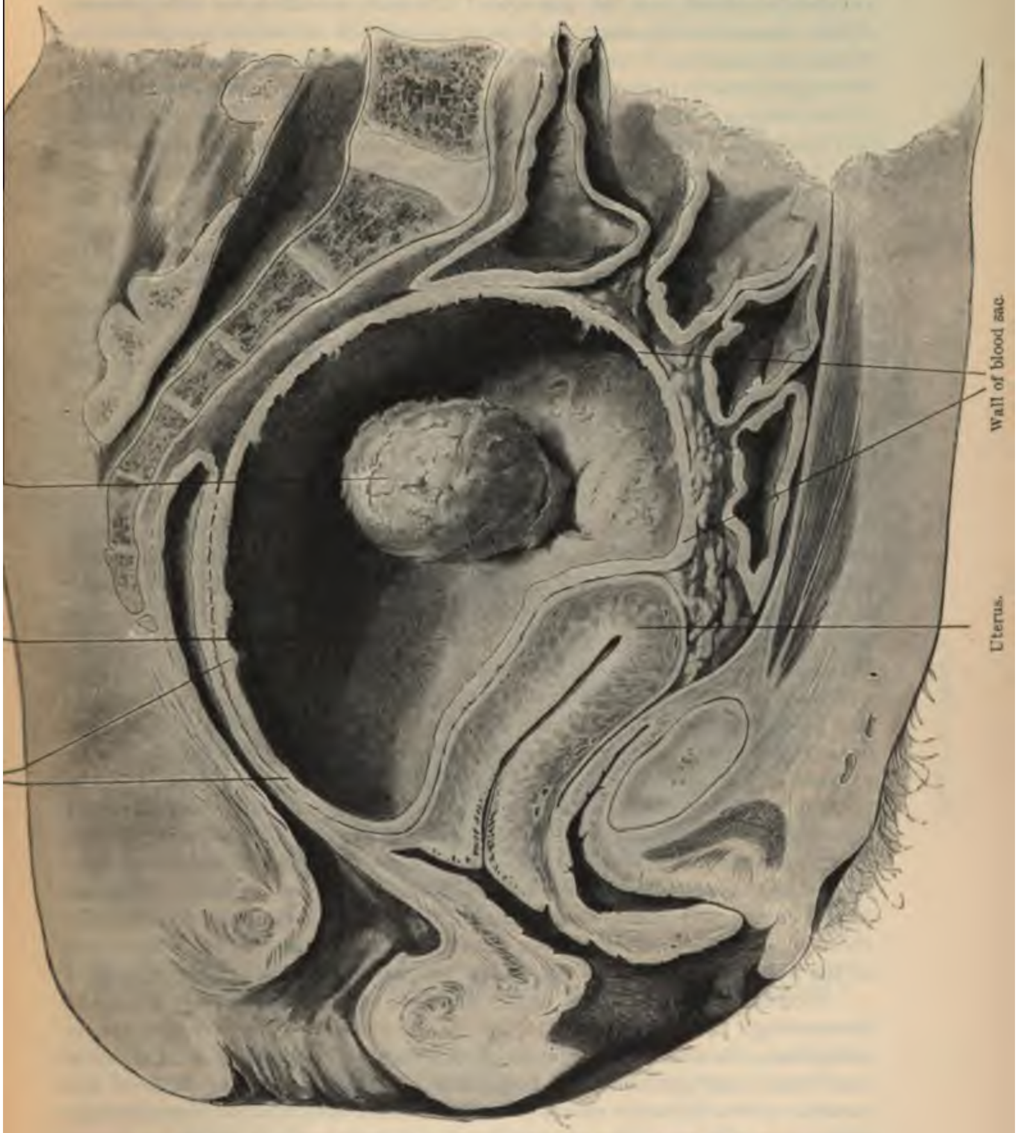


FIG. 142.—A sagittal section of a retro-uterine hæmatocele. (From Bumm.)

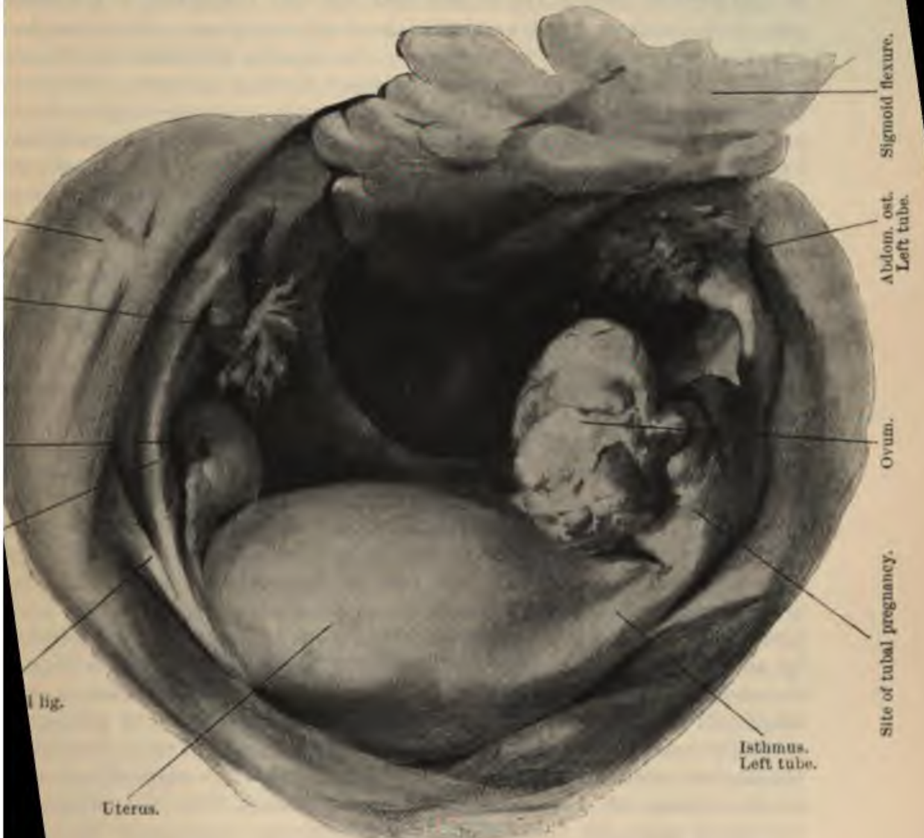
and the ease with which it can be detected on bimanual examination, are very characteristic (Fig. 142). Occasionally the uterus is retroverted and situated below the tumour, which fills up more or less completely the utero-vesical pouch of peritoneum. In most cases the uterus and the tumour are closely united, and the passage of a sound reveals some enlargement of the uterine cavity, such as is usual in cases of extra-uterine gestation. When the tumour is very large, it may push down the posterior wall of the vagina nearly to the vulva. In other cases the apparent low position of the tumour is due to œdema of the vaginal tissues. When the pouch of Douglas has been previously obliterated, the lower end of the tumour may be on a level with, or even above, the plane of the pelvic brim.

In cases of peritubal hæmatocele, a soft, boggy, tender mass, with an indefinite outline, is felt in the pelvic cavity, situated behind and to one side of the uterus. This organ is usually displaced to the opposite side of the pelvis, and owing to the indistinctness of the outline of the blood-clot the degree of alteration in the position of the uterus is of importance in determining the size of the hæmatocele (Fig. 143). In cases where the tumour is somewhat larger, it can be felt extending above the level of the pelvic brim with a convex upper border.

In the extraperitoneal form a tumour can usually be felt only on pelvic examination, laterally situated, bulging down the vaginal fornix to some extent, displacing the uterus to the other side and perhaps a little upwards, and simulating very closely the tumour met with in cases of pelvic cellulitis. It rarely reaches the level of the pelvic brim, but may pass up into the iliac fossa as far even as the crest of the ilium, and form a characteristic swelling with a convex upper border extending from near the middle line laterally almost to the anterior superior spine and vertically above Poupart's ligament for a distance of two inches or so. Douglas's pouch is usually free from any swelling, but occasionally the extravasated blood surrounds the uterus, rectum, and bladder, and a ring-like mass encircling the bowel at the level of the utero-sacral ligaments is very characteristic both of an effusion of blood and of an inflammatory exudation in the pelvic cellular tissue. The upper border of the tumour is well defined, whilst the lower is uneven and indefinite, and blends imperceptibly with the surrounding tissues. The mobility of the uterus is interfered with to some extent, and in some instances elongation of the cervix is produced by the presence of the tumour. Œdema of the vagina and of the lower extremities may be seen; and occasionally there is ecchymosis of the upper part of the vagina and of the lower part of the abdominal wall, but only when the hæmatocele is extraperitoneal.

Prognosis.—The danger of the death of the patient directly from the hæmorrhage is a very real one, but if she recovers from the first severe symptoms, the subsequent course of the case will depend on a number of conditions, amongst the most important of which is the causation of the tumour. Death rarely results from a typical hæmatocele, but the condition nevertheless is one of considerable danger to the patient.

In the case of tumours due to causes other than extra-uterine gestation, the tendency is for the swelling gradually to disappear and for complete recovery to take place. In those tumours, on the other hand, vhich have originated from a tubal pregnancy, the presence of the liseased tube must be taken into account. Further than this, the ecessity for a surgical operation will render the prognosis more unfavour-ble, as there will be the added danger of the surgical interference, while f the tube be not removed it may cause subsequent suffering and dis-



.—Rupture of the tube and hæmorrhage into the peritoneal cavity in a case of pregnancy in the thmal portion of the left tube. (From Bumm.) A preparation in the Pathol. Institute in asel.

. The liability to repeated hæmorrhages, which cannot be fore-s always to be remembered. Other dangers are the possibility of ation, the development of peritonitis, or the bursting of the collec-matter into one of the hollow viscera. The condition of the when the latter accident occurs is a very grave one; symptoms c poisoning may form a very serious complication, or she may exhausting diarrhœa or an attack of peritonitis. Lastly, if the patient escape the dangers of the original hæmorrhage and also the risks of suppuration, she is apt to be left in a condition of incomplete recovery, with the pelvic organs more or less fixed by adhesions, and with sterility resulting from the occlusion of one or both Fallopian tubes.

The general tendency is, however, towards recovery, if the effects of the primary attack are surmounted and the absorption of the blood and of the inflammatory exudation is usually complete. How complete the recovery may be is shown by the figures, published by Thorn, relating to the subsequent obstetric history of these patients. Of fifteen cases of true hæmatocele not due to extra-uterine gestation, five of the patients subsequently became pregnant; of ten cases due to this condition, four became pregnant; and of nineteen cases of lateral hæmatocele the result of tubal gestation, two became pregnant. Of fourteen patients operated upon by Döderlein for pelvic hæmatocele, two of the women subsequently bore children at full term.

Diagnosis.—In the diagnosis of pelvic hæmatocele the greatest importance is to be given to the history of the case. This is often so typical that a diagnosis can be made, in many instances with a considerable degree of certainty, even before the patient is examined. In the case of a hæmatocele arising from a tubal gestation, the following history can usually be obtained from the patient:—A period of one or two months' amenorrhœa is followed by an attack of uterine hæmorrhage. The blood escapes in a persistent manner, is occasionally profuse and red, but is usually moderate in amount, dark red in colour, and closely resembles in appearance the ordinary menstrual flow. Shreds of decidua, or even a complete cast of the uterine cavity, may be found in the discharge. This may lead to a belief on the part of the patient that she has had an early abortion. She complains of attacks of pain in the lower part of the abdomen, accompanied by a feeling of faintness, and followed by anæmia, often very severe. Great tenderness and some swelling of the abdomen are present, and the passage of both urine and fæces may be interfered with. There are some of the changes met with in pregnancy in the breasts. A tumour is found in the pelvis behind or to the side of the uterus, resembling a distended tube; and there is marked pulsation in the vessels on the same side. Concurrently with the attacks of abdominal pain the tumour increases in size, and acquires the characteristic physical signs of a peri-tubal or a retro-uterine hæmatocele.

In the differentiation of the various kinds of hæmatoceles, the history of the case is of most assistance. A sudden onset at or near a menstrual period following some injury, and accompanied by pain of a tearing character, are important points in the diagnosis of an extra-peritoneal hæmatocele not due to an ectopic gestation. In the majority of instances it is impossible to determine with certainty any other cause for these tumours than a tubal gestation.

The swellings most likely to be mistaken for a pelvic hæmatocele are those situated in the posterior half of the pelvis and occupying the pouch of Douglas. The most important of these is an *incarcerated retroverted* *gravid uterus.* In both cases there is a period of amenorrhœa; in both there may be hæmorrhage from the vagina; and in both the patient may complain of pains in the abdomen, and of difficulty in passing water. A careful investigation of the history of the case must be made. In the patient with an incarcerated uterus a period of amenorrhœa, of three months at least, usually elapses before symptoms arise which lead her to seek medical assistance; in the hæmatocele, on the other hand, it may be but a few weeks. The character of the bleeding from the vagina will also help: in the case of the hæmatocele, as we have already pointed out, the blood is dark coloured and the flow more continuous than in the case of the incarcerated uterus; in the latter instance, when an abortion is threatened, the hæmorrhage is more likely to be excessive, the blood lost to be bright red, to contain clots, and to be associated with well-marked uterine contractions. An abdominal examination will show the distended bladder, and the passage of a catheter will demonstrate this with certainty. By a careful bi-manual examination the elastic tumour filling up the pouch of Douglas will be felt, and the absence of the body of the uterus from its normal position determined. In the case of the gravid uterus, the outlines will be more definite than in the case of the blood-mass; and a difference in the form of the two tumours, and the presence of intermittent uterine contractions, may be noted. On examination through the rectum the upper limit of the uterus may be felt; and the ring-like mass surrounding the bowel, which may be present in a hæmatocele, is not present in a case of incarcerated gravid uterus. It may also be possible to make out the direct continuity of the cervix with the tumour in Douglas's pouch, while the consistence of the pregnant uterus will be softer than that of the hæmatocele.

A correct diagnosis is of great importance, because attempts to replace a hæmatocele, under the impression that it is a retroverted gravid uterus, may lead to disastrous results. In cases where the uterus is surrounded by the mass of blood the utmost difficulty may be experienced in coming to a right decision, and in such cases the patient should be examined under an anæsthetic. That a threatened abortion with an intra-uterine gestation may be mistaken for a tubal gestation accompanied by a good deal of bleeding, must be borne in mind, and in all doubtful cases the membrane passed should be carefully examined with the microscope.

The tumour which of all others bears the closest resemblance to a pelvic hæmatocele in its chronic stages is that met with in a case of *pelvic cellulitis.* The diagnosis may be most difficult, and in the absence of a distinct history, which is often wanting, almost impossible. Pelvic cellulitis most frequently follows labour at full term or an abortion, or has some relation to an existing inflammatory condition of the uterus or appendages; it is not accompanied so frequently by menorrhagia, and is not attended by pallor and faintness, while the swelling is more likely to begin in the deeper and lateral portions of the pelvis, and is slower in formation and firmer on palpation from the first. A hæmatocele, on the other hand, more commonly begins suddenly, is more often situated behind the uterus and is soft at first, becoming harder later, or becoming soft again if suppuration occurs in the collection of blood. A further distinction is that in the hæmatocele the swelling is more commonly rounded and well defined, and displaces the uterus laterally, or upwards and forwards against the symphysis pubis and the anterior abdominal wall. In a typical cellulitic exudation the uterus is fixed to some extent, but not, as a rule, much displaced. Another important point of difference is that the constitutional symptoms follow a different order in the two cases: the febrile disturbance precedes the appearance of the tumour in the pelvic cellulitis, it follows it in the pelvic hæmatocele. In the more chronic stages of the disease the diagnosis may be still more difficult, more especially if the real condition be a hæmatocele which has become inflamed. If suppuration occurs it may be impossible to determine whether it is secondary to an effusion of blood or to an exudation in the cellular tissue.

The various forms of *ovarian* and *uterine tumours* are seldom mistaken for hæmatoceles. They are distinguished by the absence of urgent symptoms at the commencement, by their slower growth, by their circumscribed form and mobility. An ovarian tumour is rarely situated so low down in the pelvic cavity as a collection of blood; if such a tumour suppurates, however, the diagnosis presents great difficulties. Inflammatory changes may occur in the walls of the cyst, and the exudation of inflammatory lymph round it may lead to a masking of the form of the original tumour, and thus the soft centre with a hard periphery may simulate the physical signs of a hæmatocele. The diagnosis may be still more obscured by œdema of the vaginal walls. The only way of coming to a certain conclusion is to watch the progress of the tumour and to take the history of the case carefully into account. As the inflammatory deposit becomes absorbed the outline of the tumour itself will become more definite, and if it be fluctuating and unattended with signs of constitutional disturbance, it is probably ovarian in origin. Another condition which may be mistaken for a pelvic hæmatocele is hæmorrhage into an ovarian cyst. This may give rise to all the signs of internal hæmorrhage and the rapid production of anæmia. In such a case the presence of a tumour before the onset of the attack, and the history, will be of value in forming a correct conclusion. The smoothness and uniformity of the mass, the absence of a swelling in the retro-uterine pouch, the presence of any of the signs of pregnancy, and that the ovarian cyst is less likely to be closely connected with the uterus, are all points which must be given their due value in the attempt to make a right diagnosis.

Fibroid tumours of the uterus bear little resemblance to cases of pelvic hæmatocele, but yet the two conditions may be mistaken. These tumours are distinguished by their density, by their slow growth, by their position, and by their attachment to the uterus. It is, however, possible for a fibroid tumour becoming incarcerated in Douglas's pouch to give rise to a sudden and acute attack of pain; and such a tumour growing from the posterior aspect of the cervix, especially if it be a soft, rapidly-growing myoma, may be mistaken for an hæmatocele. The possibility of a hæmatocele complicating a malignant growth in the pelvis must be remembered, and cases of this kind have been recorded by Gardner (see p. 581) and Playfair.

A condition which, so far as the physical signs are concerned, closely simulates pelvic hæmatocele is a *serous effusion in the pelvis*, the result of an attack of pelvic peritonitis. Here the history of the case and other evidences of an inflammatory exudation must be relied upon in clearing up the diagnosis. A *pyosalpinx* may resemble a peri-tubal hæmatocele very closely in some respects. In most instances menorrhagia accompanies a pyosalpinx, but occasionally, though uncommonly, when the tumour is a double one and associated with changes in the ovaries, there is amenorrhœa. Not only may the tumour formed by a pyosalpinx resemble that formed by a hæmatocele, but symptoms due to the rupture of a pyosalpinx may very closely resemble those due to a rupture of the pregnant tube. In both cases there is a sudden onset of the symptoms, with collapse, abdominal pain, vomiting, and the signs of pelvic peritonitis. The previous history of the patient is of great importance. If the tumour be a pyosalpinx, she probably will have had repeated attacks of pelvic peritonitis, and possibly will have been in ill-health for some months or years. In the case of a hæmatocele, on the other hand, one of the most important points is that the patient, previous to the attack of bleeding, is usually in the best of health.

Amongst other pathological conditions which might be mistaken for a hæmatocele are *pregnancy* in the *rudimentary horn of a uterus unicornis*, or in a *uterus arcuatus*, or a collection of blood in one half of a double uterus. A careful consideration of all the symptoms combined with the history, and a thorough examination, if necessary under an anæsthetic, will usually enable a correct diagnosis to be made.

Treatment.—The treatment of cases of pelvic hæmatocele has become more and more surgical in character as our knowledge of their ætiology has increased, and so much is this the case that some writers recommend that they should all be treated by operation. In those cases in which the life of the patient is threatened by the amount of the hæmorrhage, there can be no question as to the correct treatment; the general rules of surgery must be followed, the bleeding point cut down upon and the hæmorrhage arrested. In other cases, however, where the patient has recovered from the first effects of the attack of bleeding, it is often most difficult to come to a correct conclusion as to the best treatment. In cases where the cause of the bleeding certainly is not a tubal pregnancy, the tendency is for the mass of blood, if left alone, to become absorbed. Such cases may be watched safely, and the question of any further interference decided by the course of events. In cases of pelvic hæmatocele where the cause is a tubal pregnancy, the treatment to be adopted will depend upon the fate of the ovum and the presence or absence of repeated hæmorrhages. If the ovum is still developing, whether in the early or late stages of the pregnancy, or if the tumour increases in size with the signs of recurrent hæmorrhages, then the case must be treated by operation. If, however, the ovum appears to be dead and the tumour does not increase in size, the case may be watched until it is seen whether the blood-clot shows any signs of becoming absorbed or not. If, after a sufficient lapse of time, this does not occur, or if symptoms arise indicating that suppuration has taken place in the tumour, an operation must be undertaken.

If it be decided to adopt palliative measures only, the most important of these is absolute, complete, and sufficiently prolonged rest in bed. The greatest care must be taken to keep the patient perfectly quiet, and all movements on her part must be interdicted. If there are any signs that the bleeding is continuing, an injection of morphia should be administered and an ice-bag applied to the abdomen. Vigorous measures directed towards combating the shock cannot be adopted until it is certain that no further bleeding is taking place, or they will tend to increase it. The injection of strychnine, the administration of brandy, and the intravenous or the subcutaneous transfusion of saline solution can be carried out if the bleeding has been arrested by operative interference, or if the symptoms indicate that it has ceased at any rate for the time. But if the bleeding has not been arrested permanently by the ligation or the removal of the tube, then the risk of its recurrence must be borne in mind.

When the patient has recovered from the immediate effects of the bleeding, and it has been decided to try the effect of prolonged rest in bed, the future treatment of the case is of the most simple kind. Absolute and complete rest in bed must be insisted upon, the bowels kept open by free purgation, and the variations in the size of the blood-mass carefully watched from day to day. The employment of hot vaginal douches, the use of icthyol or glycerine plugs, may be of some assistance, but anything that leads to the unnecessary disturbance of the patient must be carefully avoided.

An important factor to be borne in mind in deciding the question of ultimately treating this class of case by operation is the social position and the surroundings of the patient. Can she afford to lie up for the length of time required to allow a large collection of blood to become absorbed? We have seen that the average duration of such a case is about four months: a considerable period of time for a poor woman, and perhaps a bread-winner, to be laid aside from work. Although such considerations must not be given undue weight, yet they must be taken into account, more especially at the present day, when operations for the removal of the blood-mass can be undertaken so safely.

A further point to be remembered is that even when the tumour has become almost completely absorbed, or has diminished to a very small size, the patient is not necessarily completely cured. She may, and often does, suffer some disability from the presence of the diseased tube, or from the adhesions or the inflammatory masses which may persist in the pelvis. The normal relations of the pelvic organs are rarely entirely regained, and in cases where the hæmatocele has formed as the result of an advanced tubal gestation, remains of the fœtus may be found many months after the date of its death. A case recorded by Kretschmar is an interesting example of this, where, at a laparotomy undertaken thirteen years after the probable date of its death, the bones of a three months' old fœtus were found. While the general statement remains true that practically all cases of hæmatocele due to any other cause than an extra-uterine gestation, and many of those due to an early tubal gestation, ultimately will undergo absorption; yet the length of time required, the risk of repeated possibly very severe hæmorrhages, the liability to some subsequent disability, and the safety with which at the present day operations can be undertaken for their removal, render it probable that in the near future the treatment of this condition will become more and more surgical in character.

In any cases in which the signs of suppuration are present, an immediate operation should be carried out, and this may often be performed most safely by the vaginal route. The details of the various operations will be considered in the section on Ectopic Gestation.

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EXTRA-UTERINE GESTATION

One of the greatest discoveries man ever made concerning himself was when in 1827 von Baer detected the human ovum, and established the nature of the human ovary.

All intelligent persons now know that the ovum, when mature, escapes from its follicle in the ovary and falls into the cœlomic (abdominal) ostium of a Fallopian tube, to be conveyed by the muscular action of this tube into the uterus; when the environment is favourable, somewhere in transit this ovum (or egg) is fertilised by a spermatozoon, and converted into an oösperm (as the fertilised ovum is called) and retained within the uterus; under normal conditions it develops into a fœtus, and is finally extruded as a living child.

There is, however, a great deal of uncertainty concerning the place where the ovum becomes fertilised; but it is now established that fertilisation may occur whilst the ovum is in the follicle, for oösperms have been detected in the ovary as well as in the Fallopian tube and in the cavity of the uterus. When an oösperm is formed in any part of the genital tract other than in the cavity of the uterus, it is said to be extra-uterine; and when this occurs in the ovary or in the Fallopian tube, the conditions are termed ovarian and tubal pregnancy respectively. There are also two anomalous conditions which it is convenient to include under the heading of extra-uterine; namely, pregnancy in the rudimentary cornu of a two-horned uterus (cornual pregnancy), and the very rare form known as utero-abdominal pregnancy.

Ovarian Pregnancy

Belief in ovarian pregnancy can be traced back for more than 200 years; but a critical examination of the recorded cases shows that the supposed ovarian fœtus was in some instances a dermoid, in others an extra-uterine fœtus sequestered in the broad ligament. In a few cases the accounts of the dissection are so careful and so circumstantial as to leave an impression on the mind that the development of an embryo in the ovary could not be denied. Capable observers like Velpeau and Farre, though they did not deny the possibility of gestation in the ovary, were satisfied that in none of the reported cases had the fact been proved.

The following is an example of such evidence. In 1682 M. de S. Maurice, M.D., wrote a letter concerning the formation of a fœtus in the testicle (ovarium), which was published in the *Journal de Médecine*, January 1683. The patient had been safely brought to bed eight times, and after an interval of five years she again suspected herself to be pregnant. The lady appeared to be in good health, when she suddenly exhibited all the signs indicative of internal bleeding; "she called her surgeon and died in his arms." At the post-mortem examination the belly was found to contain a prodigious quantity of free blood and clot and a male fœtus nearly as big as a thumb. The right testis (ovary) was torn lengthwise, and contained a cavity full of clotted blood. The testis (ovary) was as big as a hen's egg. The Fallopian tubes were intact, and showed no signs of having been occupied by an embryo. The uterus was intact, and resembled this organ in the first month of pregnancy. The account ends with the following significant sentence:—"Authors speak of certain fœtuses found in the tubes, and of others that have been found in the cavity of the belly, neither the womb nor the tubes having been found in anyway torn; but I do not think that any person hitherto has been able to show that conception is made in the testicle or ovarium" (*Philosophical Transactions*, Abridged Edition, vol. ii. p. 650).

This letter is also interesting as showing how slowly the term *ovarium*, introduced by De Graaf in 1671, was displacing the name testicle, which had been in use for the female as well as the male genital gland.

In recent years the discovery of the tubal mole has furnished us with a criterion of extra-uterine pregnancy, and led active investigators to formulate a postulate on which the occurrence of ovarian pregnancy could be based; if their doubts were to be satisfied, they urged that *an early embryo in its membranes contained in a sac in the ovary* should be forthcoming. These conditions have been satisfied by a remarkable case published in 1899 by Dr. Catherine van Tussenbroek of Amsterdam. It appears that Kouwer of Haarlem, in 1893, performed cœliotomy upon a woman thirty-one years of age, on account of signs indicating severe abdominal bleeding. The abdomen contained a large quantity of blood, and the source of the bleeding was a swelling, the size of a nut, in the right ovary. The diseased ovary and tube were removed as well as the blood-clot, and the patient survived; although it required many months for her to recover from the severe loss of blood. Van Tussenbroek preserved the specimen, and some years later made careful complete sections through the ovarian "swelling," and demonstrated beyond any doubt the presence of an early embryo in a sac furnished with chorionic villi, and contained in an ovarian follicle. Apart from its interest and value in absolutely proving that an ovum can be fertilised in its follicle, a study of this specimen ought to settle many doubtful points in regard to the source of some of the constituents of the placenta. There is another point of great importance noticed in the clinical account of this patient, namely, that a decidua had formed in the uterus, and a few days subsequent to the operation was discharged with the *douleurs d'accouchement*.

Some similar cases, but none so convincing as that of van Tussenbroek, have been reported in England; and it is an interesting result that the great reliance which has been placed on the chorionic villi as the determining feature of doubtful specimens of tubal mole is likely to be of equal utility in the case of "ovarian mole."

The whole subject of ovarian pregnancy now stands in a new light; and it opens up a wide field of research for those who get the opportunity to carefully investigate suspected cases of early ovarian pregnancy, more especially examples of what are called blood-cysts of the ovary, and thus endeavour to secure a complete series of specimens to fill up the interval between an embryo of a few days and the fully developed fœtus.

TUBAL PREGNANCY

Cause.—In order to reach the uterine cavity the ovum must traverse the Fallopian tube. When an oösperm (fertilised ovum) is retained in the tube it continues to develop, and gives rise to the condition known as tubal pregnancy.

The causes of the arrest of an oösperm in the tube are unknown; and our ignorance will continue until we have some trustworthy information concerning the situation in the genital passages where ovum and spermatozoon normally meet. It is probable that fertilisation usually happens in the uterus, and that when it occurs in the tube it is accidental, and tubal gestation the consequence.

Obstruction to the transit of ova will not explain matters, for an oösperm is more often retained in the wide ampullary section of the tube than in its uterine segment. In regard to the obstructive notion, it is worthy of remark that *uterine* pregnancy has occurred after the Fallopian tubes have been tightly girt in their middles by silk ligatures. My own observations teach me that tubal pregnancy is the result of active rather than of obstructive causes. The union of a spermatozoon with the nucleus of an ovum not merely initiates, in the previously passive cell, most marvellous and rapid changes ending under favourable conditions in the production of a new individual, but in some unknown way exerts also an extraordinary influence on the reproductive organs. Hence it is probable that when an ovum is fertilised the resulting oösperm engrafts itself at once on, or embeds itself into, the subjacent mucous membrane, whether tubal or uterine.

Tubal pregnancy may happen as a first pregnancy in a woman who has been married eight, ten, or even twenty years. A woman, thirty-seven years of age, from whom I removed a gravid tube five weeks after primary rupture, had been married twice; her matrimonial life had extended over seventeen years before she conceived, and her first pregnancy was tubal. Tubal pregnancy may follow normal gestation, or an abortion, within a few months; or it may occur as a first pregnancy in a woman of twenty, or one of forty years. A Fallopian tube may become gravid in the newly married, or in the mother of a large family. Both tubes have been found gravid at the same time, but the pregnancies have been of different dates, and though concurrent, were not necessarily simultaneous (see p. 633). It is possible that two oösperms may be retained in the same tube (see p. 630). An analysis of a large number of cases establishes the view that the occurrence of tubal pregnancy is often preceded by a long interval of sterility.

The occurrence of pregnancy in the Fallopian tubes after a long period of sterility in women who have borne children led Tilt, and subsequently Lawson Tait, to believe that these patients had suffered from desquamative salpingitis, and that the destruction of the tubal epithelium had hindered the ovum in its passage to the uterus.

I have devoted much labour to the investigation of the minute changes in the mucous membrane of gravid tubes. In some specimens there is evidence of old inflammation; but it must be pointed out that salpingitis, so severe as to produce destruction of the tubal epithelium, causes profound changes in the tubes, and leads to stricture and complete occlusion of their cœlomic (abdominal) ostia; when the tubes are denuded of their epithelium it is exceedingly rare to find the cœlomic ostia patent. In many specimens of very early tubal pregnancy I have failed, even after the most careful microscopic examination, to find any evidence of old salpingitis or loss of epithelium.

It is probable that chronic salpingitis of a mild degree may account for the sterility and the subsequent tubal pregnancy in a small proportion of cases; but it fails to account for a very large number of them. Indeed the evidence now indicates *that a healthy Fallopian tube is more liable to become gravid than one which has been inflamed.* Chronic salpingitis becomes even less satisfactory as an explanation of tubal pregnancy when we reflect that, in some of the specimens, the inflammatory changes are the consequence rather than the cause of tubal pregnancy. It is a matter of common observation that in some cases of tubal pregnancy, particularly those occurring in women who have conceived in the uterus, that the Fallopian tubes are unusually thin: it has been suggested that puerperal involution of the tubes may induce atrophy of their tissues, and thus become an important factor in the causation of tubal pregnancy (Prof. Taylor). Although changes of this character, or mechanical conditions induced by the presence of ovarian, parovarian, or uterine tumours, may explain a few cases, the causes of tubal pregnancy in most cases remain undetected. This ignorance is probably due to the fact that we know nothing of the changes in the human oösperm in its early days. I have for many years urged that tubal pregnancy is the result of active changes, and the following suggestion made by Ballantyne appeals to me:—"The trophoblast is recognised as the means by which the oösperm attaches itself to the uterine wall; should it be detained in the tube until the trophoblast be fully formed, or if the trophoblast be formed prematurely, it may effect a lodgment on the tubal mucosa."

Our knowledge of the events consequent on the retention of an oösperm in the tube is fairly complete; and, as they vary according to its position, gestation in the ampulla and the isthmus is called *tubal*, and in the portion which traverses the uterine wall *tubo-uterine* pregnancy. This variety will require separate consideration.

The stages of *tubal* pregnancy will be discussed in sections, thus:—Changes in the tube, the tubal mole, tubal abortion, tubal rupture, erosion of the tube.

The Changes in the Tube.—During the first month or six weeks following the lodgment of an oösperm the tubal tissues are swollen and turgid; occasionally at the site where the villi are implanted the tubal wall becomes very thin. This is attributed by some observers, and probably correctly, to the phagocytic or other activity of the cell-elements of the chorionic villi. The precise relation of the villi to the tubal tissues has recently been made the subject of some careful investigations (Fürth, Lockyer), which show that quite early in the course of the pregnancy (2nd week) the cells of the villi make their way through the mucosa and become implanted in the muscular coat of the tube. This is known as the *intramural embedding of the placenta*, or better, *intra-muscular implantation of the villi.* It has also been shown from an examination of some early specimens of tubal pregnancy that the oösperm may entirely encyst itself in the muscular wall of the tube (Comyns Berkeley and Bonney). In many cases, especially when the oösperm is lodged in the ampulla of the tube, the cœlomic ostium gradually closes by a process very analogous to that described as resulting from salpingitis. Occlusion of the ostium is a slow process; it requires probably eight weeks for its completion. When the oösperm is retained in the isthmus or in the uterine section of the tube, the cœlomic ostium is rarely affected. In a fair proportion of cases the ostium dilates instead of contracting. There is as yet no good explanation of these two opposite conditions, but they exercise an important influence on the subsequent course of the pregnancy. A widely expanded or patent cœlomic ostium disposes to tubal abortion. A gravid tube with a patent ostium may rupture as well as abort; a gravid tube with an occluded ostium almost invariably bursts. Microscopic investigation of the uterine orifice of the tube serves to show that it is not obstructed when the tube is gravid. Mere investigation by means of a bristle or probe is too rough a method to be reliable.

The condition of the uterine segment of the tube is of some importance in connection with the clinical features of tubal gestation. It was assumed, by some of the older writers on extra-uterine gestation, that obstruction in this part of the tube would help to explain retention of the ovum in the tube. This is, of course, untenable, because it would likewise prevent the entrance of spermatozoa into the tube. In many cases of tubal gestation the patient complains of irregular discharges of blood from the vagina; this seems to be observed more especially in cases of tubal abortion. It is certain that some of this blood is effused into the tube and trickles through the uterine orifice into the cavity of the uterus.

Tubal Moles.—The changes which occur in the oösperm subsequent to impregnation, whether it be retained in the tube or in the uterus, are identical; in both situations it is liable to a curious change whereby it is converted into what is known as a mole. Uterine moles are common in pathological museums, and few matrons terminate the reproductive period of life without producing one or more examples of abortion. When a mole is examined soon after extrusion it resembles a firm blood-clot in colour and consistence. On dividing it a cavity is found containing fluid, which is sometimes straw-coloured, sometimes stained red from admixture with blood. The walls of this cavity are smooth and lined with amnion, and often a misshapen fœtus or the stump of an umbilical cord is contained within; frequently, however, there is no trace of an embryo.

In 1889 I was able to demonstrate that moles occur in connection with tubal pregnancy; and since that date such a large number of examples has been described that the tubal mole has become a familiar object.

The characters of tubal mole, based upon a careful study of one hundred and thirty specimens, may be summarised thus :—

Tubal moles vary greatly in size : some have a diameter of 1 cm., others of 5 or 8 cm., and on rare occasions even larger. Small moles are globular, but after attaining a diameter of 3 cm. they assume an ovoid shape.

The amniotic cavity usually occupies an excentric position (Fig. 144). Occasionally an embryo is present ; often it is misshapen and ill-developed. In a great many specimens, owing to the excentric position of the amniotic cavity, its walls are ruptured and the embryo is lost. The outer investing membrane — the chorion —is usually shaggy with villi, which become more obvious if the mole be exposed to a gentle stream of water. In some specimens the amniotic cavity is effaced ; if such moles be sectioned and examined microscopically, the chorionic villi will be found cut transversely or obliquely.

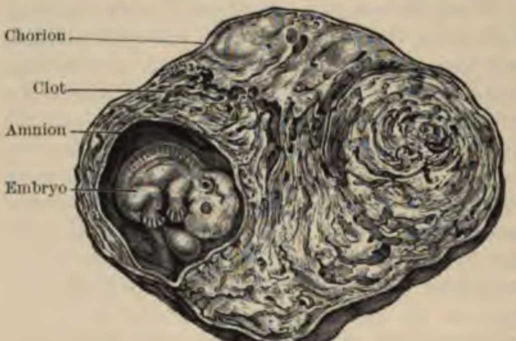

FIG. 144.—Tubal mole in section. (*Nat. size.*)

Recent moles resemble a piece of blood-coagulum, and are dark red. When they have been free in the peritoneal cavity (cœlom) or lodged between the layers of the mesometrium (broad ligament) for days or weeks, they are sometimes yellow externally, and often firm and hard.

The majority of tubal moles are easily recognised ; but a doubt may arise when the amniotic cavity is obliterated. In a doubtful case of this kind the presence of chorionic villi determines its nature. The villi usually appear as clusters of circular bodies : ten or more may, in fortunate sections, be counted together ; more frequently they occur in groups of three or four, and often a wide section of clot may be examined without finding more than two or three. Under a low power they present an external layer of epithelium, and the central space is occupied by delicate connective-tissue cells and blood-vessels. Under a high power the so-called epithelium resembles a large multinuclear cell enveloping the villus, its nuclei being arranged with great regularity. In large villi a double row of cells is often seen. The outer investing layer of the chorion is sometimes called the syncytium, and has assumed some importance in relation to chorionepithelioma (deciduoma).

The structure and mode of formation of these moles are of great interest. In the early stages of development the relations of the membranes are somewhat different from those which obtain at a later period, and it is significant that moles arise only in the first few weeks following fertilisation. Soon after the chorion is shaggy with villi, the embryo will be found in the amnion; between the amnion and the chorion there exists a space (which may be called the subchorionic chamber) filled with albuminous fluid (Fig. 145).

As the embryo increases in size the amnion gradually encroaches on this space, and eventually obliterates it; but for a time a potential space exists between the two membranes (Fig. 146) exactly resembling that between the visceral and parietal pleura.

The most cursory examination of a typical tubal mole will convince the observer that the blood is limited externally by the chorion and internally by the amnion. It is obvious that this blood *occupies the subchorionic chamber.* Thus the elliptical shape of large tubal moles is at once explained.

We have now to determine the source of the blood. Many observers have hitherto been content to believe that a mole is formed by an irruption of maternal blood into the embryonic membranes. The blood, according to my own observations, is furnished by the circulation of the embryo. This view is further supported by the character of the blood. The blood of the embryo differs from that of the adult in the fact that the red corpuscles are nucleated; now observations on blood from fresh tubal moles show that the red corpuscles are nucleated.

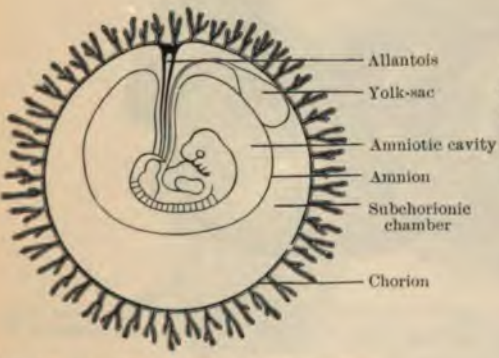

FIG. 145.—Diagram to show the early relations of the amnion and chorion and the subchorionic chamber.

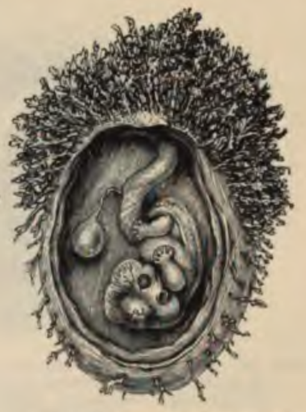

FIG. 146.—An early tubal embryo, showing the polar disposition of the villi, etc. (*Nat. size.*)

It is clear that *a tubal mole is due to blood extravasated from the circulation of the embryo into the subchorionic chamber.*

It must be distinctly understood that these observations apply only to blood within the chorion. It does not follow that the blood found within the subchorionic chamber is the result of a single hæmorrhage: careful examination of tubal moles demonstrates that the blood is often disposed in laminæ like that found in a sacculated aneurysm. This is sufficient to prove that, in some instances at least, the formation of a tubal mole is a gradual process.

In many cases tubal moles are found immersed in blood extravasated from the maternal vessels. Occasionally mole-containing tubes come to hand in which no blood is effused between the chorion and the tube. In such cases evidence that the blood comes from some source within the chorion is irrefragable. Tubal moles arise only in the first two months following fertilisation.

Although tubal pregnancy is extremely common, it is very singular that in nearly every case of rupture or abortion before the twelfth week the products of conception are represented by a mole. In many score of cases the writer found two exceptions only, and the specimen Fig. 146 is one of them. This shows that a Fallopian tube is by no means a favourable situation for the development of an oösperm; indeed, its detention in the tube is disastrous, and Werth pithily sums it up thus: "*Das Ei gräbt in der Tube nicht nur ein Bett, sondern auch sein Grab.*" With equal truth we add that it is an event which consigns many healthy women also to an early grave.

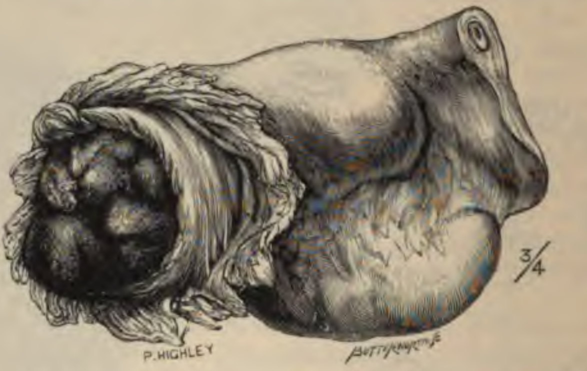

FIG. 147.—A gravid Fallopian tube and ovary removed from a single woman twenty-three years of age. At the time of the operation the mole was in process of extrusion from the tube (Museum of the Royal College of Surgeons). (*Trans. Obst. Soc. London*, vol. xlii. p. 311.)

Tubal Abortion.—It has been pointed out already that the presence of an oösperm in the outer third of a Fallopian tube often leads to occlusion of the cœlomic (abdominal) ostium: this event is commonly complete by the end of the sixth week; sometimes it is delayed to the eighth week; it is therefore a comparatively slow process.

So long as this orifice remains open the oösperm is in constant jeopardy of being extruded through it into the peritoneal cavity (cœlom), especially when it lies in the ampulla of the tube; the nearer it is situated to the ostium the greater the chance of this extrusion. To this accident the term *tubal abortion* is applied, for it is exactly parallel to those early abortions occurring in uterine gestation before the end of the second month; and it further resembles them in that the oösperm is nearly always converted into a mole (Fig. 148).

The term tubal abortion was introduced by Werth, and in its simplest sense is applicable to the condition in which bleeding takes place from a gravid tube and the blood escapes through the unclosed cœlomic ostium into the pelvic cavity.

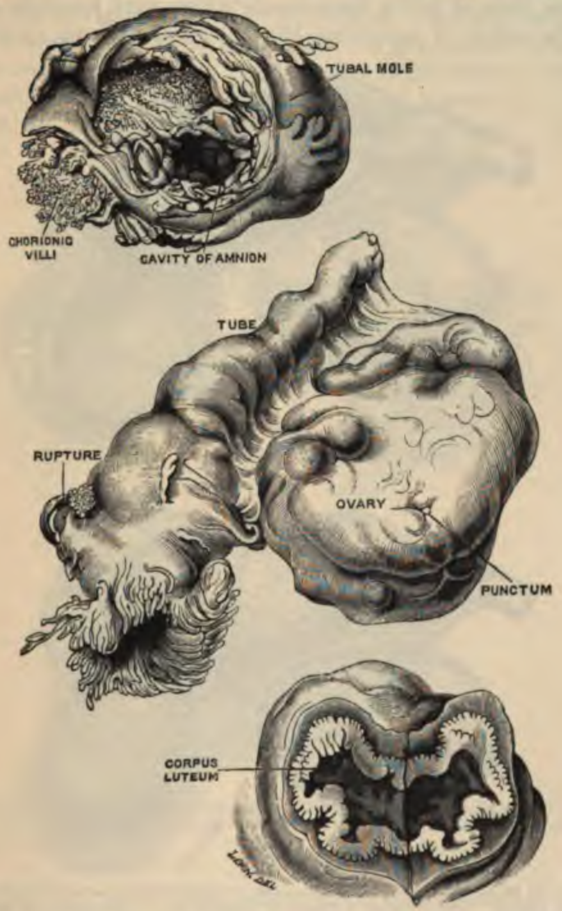

Fig. 148.—Fallopian tube and ovary, mole and corpus luteum from a case of complete tubal abortion. (*Nat. size*). There is also a small rent in the tube (*Trans. Medical Society*, London, 1892).

Many of these cases resemble early uterine abortions in which a mole is expelled, accompanied by a free discharge of blood from the uterus. In tubal abortion the same thing happens. The mole is discharged through the ostium with a copious hæmorrhage into the peritoneal cavity; the patient presents the usual signs of internal bleeding, and rapid death may occur from the consequent anæmia, or from shock. In such instances the mole, being very small, often escapes recognition when the clot is examined, whether after an operation or after death.

Tubal abortion is a subject of much interest, inasmuch as it furnishes many of the cases of pelvic hæmatocele which were formerly ascribed to metrorrhagia, reflux of menstrual blood from the uterus, or hæmorrhage from the mucous membrane of the Fallopian tube. The reason for associating the hæmorrhage with metrorrhagia and menstruation is the observation that, whilst the embryo is growing in the tube a decidua is forming in the uterus. When tubal abortion occurs, hæmorrhage takes place from the uterus, consequent on the separation and expulsion of the decidua. Should this accident happen near the time the patient expects to menstruate, the case might be regarded as reflux of menstrual fluid into the peritoneum. In some cases the blood discharged from the uterus is

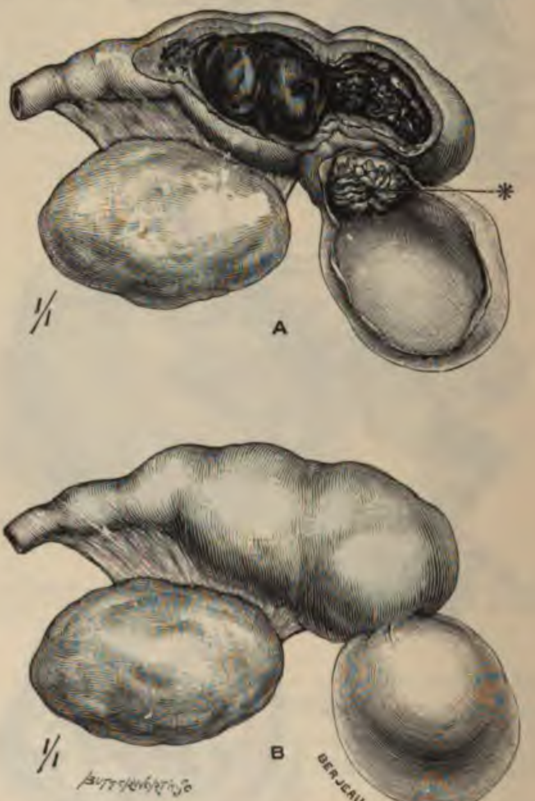

FIG. 149.—A gravid Fallopian tube with a pseudo-cyst, or capsule formed around blood effused through its cœlomic ostium. This is called a Peritubal hæmatocele. A the capsule in section, B entire; * tubal fimbriæ.

derived from the gravid tube; this happens especially in cases of protracted tubal abortion.

It is necessary to bear in mind that in early uterine abortion the mole often fails to become completely detached from the uterine wall; bleeding recurs so long as the mole is retained. In tubal pregnancy the same thing happens; the mole, so long as it is not ejected from the tube, gives rise to recurrent bleeding or maintains a continuous "blood-drip" into the pelvic cavity (Taylor). This may be described as *incomplete tubal abortion*, and is more common than the complete form. When blood slowly trickles from the cœlomic ostium of the tube in cases of incomplete tubal abortion it is apt to become encysted, and the outer surface of the clot is then encased by a regular capsule. In many instances this capsule is so perfect that it may be enucleated entire; and when the blood is carefully removed the capsule appears as a cyst at the extremity of the Fallopian tube with the fringed ostium opening into it (Fig. 149). This condition was detected independently by Sänger and Taylor. The essential factor in the formation of a *peritubal hæmatocele* seems to be the slow trickling or "blood-drip" from the gravid tube. Similar capsules form around inflammatory exudations from the tube in association with gonorrhœal and tuberculous salpingitis (see also Paratubal Hæmatoceles, p. 615).

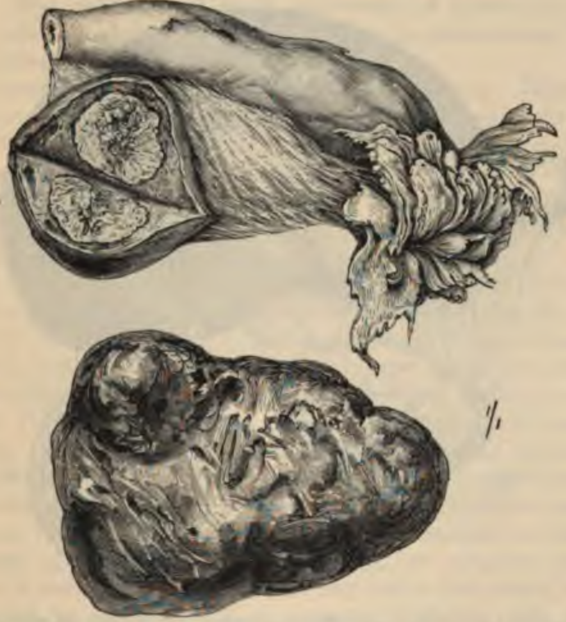

FIG. 150.—Fallopian tube, ovary (containing a corpus luteum), and mole; from a case of complete tubal abortion. The patient was thirty-five years of age, mother of ten children, the youngest being three months old.

It is important to remember that a gravid mole-containing Fallopian tube will, after discharging the mole through its cœlomic ostium, return to its normal size exactly like the uterus after labour (Fig. 150). In regard to this, the student should remember that if any one unacquainted with the remarkable properties of unstriped muscle were shown a fœtus at term in its amnion, and the retracted uterus an hour after delivery, it would appear almost incredible that the amnion and contents had been housed in the centre of the uterus. I make this observation because some thoughtful men, thoroughly familiar with the behaviour of the uterus, fail to comprehend that a similar state of things happens with the Fallopian tubes.

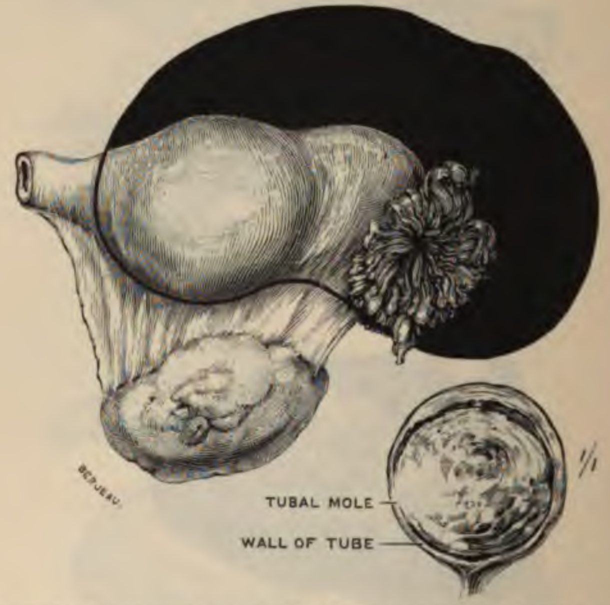

FIG. 151.—A gravid mole-containing tube. The blood clotted and distended the tube until it assumed the shape shown in black; the clot was then slowly discharged through the cœlomic ostium. Four clots were found in the pelvis.

In some very rare cases of incomplete tubal abortion the blood accumulates and coagulates in the tube, and the clot is gradually discharged through the cœlomic ostium into the pelvis; each "delivery" being accompanied by an attack of pain. These clots are solid, uniform, and do not possess an outer organised limiting membrane (Fig. 151).

Chorionic polypus in the tube.—It is not an uncommon event after a uterine miscarriage, or even after delivery at term, for a portion of the placenta to retain its connection with the uterine wall, and to remain in the uterus long after the fœtus and placenta have been discharged. The common clinical phrase for this event is "retention of some of the products of conception"; and the amount of "products" retained may vary from a fragment the size of a coriander seed to a piece measuring a few square inches. I have satisfied myself that some of the cases of "incomplete tubal abortion" are of this nature; the main part of the mole is extruded with the blood into the pelvis, and is not recognised at the time of the operation; the organised body which remains in the tube consists of a conglomeration of chorionic villi at the seat of implantation, and it may become hard and often rounded like the so-called placental polypus in the uterus. Retained villi in the tube are as mischievous as those in the uterus, inasmuch as they keep up a persistent trickling of blood. The detection of small collections of chorionic villi in the Fallopian tube has often been of great service in determining the source of the bleeding in doubtful cases

Tubal abortion has become a subject of importance. When attention was first drawn to the accident many observers regarded its occurrence as questionable or of great rarity; now the condition is well recognised, and in the practice of some observers it is reported to be the most frequent mode by which tubal pregnancy terminates (Cullingworth and Taylor). In my long series of cases the proportion of tubal abortion to rupture of the tube is as 1 to 4.

Tubal Abortion and Tubo-Abdominal Pregnancy.—It has been assumed that tubal abortion occurs only in the early weeks, but a case has recently been described in which the embryo was retained in the tube until it attained the size of 10 centimetres; abortion occurred, and the whole of the fœtus, except its head, which was too large to pass, was discharged through the cœlomic ostium of the tube (Cullingworth and Fairbairn). It has also been proved that a tubal fœtus may escape from the gestation sac into the belly, and sever its connections with the placenta without destroying its mother. Dr. Mendes de Leon has published a remarkable example of this; he removed a fœtus of the sixth month tightly enclosed in its amnion, but adherent to the great omentum; it had no connection with any other abdominal viscus. At the operation he removed also an enlarged Fallopian tube which contained an atrophic placenta, clearly indicating the primary situation of the gestation.

Dr. Cullingworth has published an account of a very exceptional example of tubal pregnancy which is useful as illustrating the manner in which a fœtus is extruded from a tubal gestation sac. The specimen shown in section, Fig. 152, represents two compartments; the inner is occupied by the placenta engorged with blood and clot, and the outer sac contains a fœtus surrounded by a delicate membrane, probably amnion. In this instance the fœtus was extruded either through a rent in the tube or perhaps through the cœlomic ostium, but retained its connection with the placenta. In Mendes de Leon's specimen the extrusion was complete. Pestalozza recently operated on a woman for secondary abdominal pregnancy and found a fœtus in the recto-vaginal pouch; the placenta occupied the ampulla of the tube, and the umbilical cord passed through the cœlomic ostium of the tube. (See Utero-Abdominal Pregnancy, p. 625.)

Rupture of the Gestation Sac.—As a rule, every gravid tube left to itself either aborts, bursts, or is eroded. When from any cause the pregnancy is disturbed before the cœlomic ostium is occluded, the probability is in favour of abortion; but a gravid tube may rupture in spite of a patent ostium. When the pregnancy advances until the ostium is closed, then the tube usually bursts at some period between the sixth and tenth week following impregnation; this accident is rarely deferred till the twelfth week, but cases have been reported in which the tubal walls remained entire even to the sixth month. In one very carefully observed case in which tubal pregnancy supervened on a single insemination, the tube burst on the fifteenth day, and the woman died in a few hours (Rumley Dawson). This is called primary rupture, and may be intraperitoneal or extraperitoneal. The determining causes of the rupture are of various kinds, such as jumping from a train, chair, or carriage, defæcation, sexual congress, examination of the uterus, and the like. Occasionally no such influence is demonstrable. Erosion is a much rarer event in the course of tubal pregnancy than abortion or rupture, and will be considered separately. A gravid Fallopian tube may undergo axial rotation; instances of this rare accident have been recorded by Martin and Pozzi.

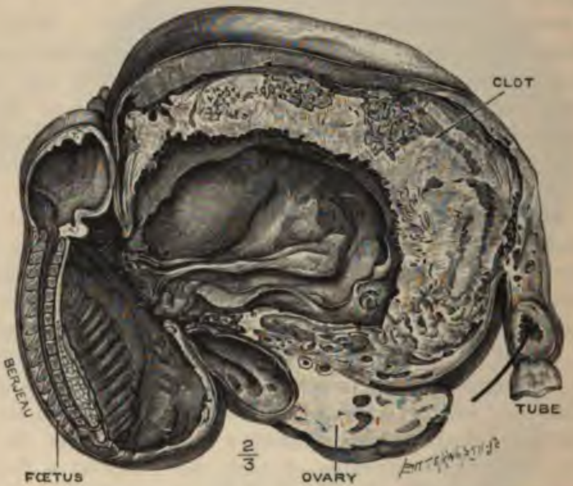

Fig. 152.—A gravid Fallopian tube in which the fœtus has been slowly extruded from the tube. Dr. Cullingworth's case. (Museum of St. Thomas's Hospital.)

The predisposing causes of rupture are the gradual attenuation of the walls of the gestation sac and the undue distension of the membranes by hæmorrhage. The tubal wall is particularly thin at the seat of implantation of the chorionic villi, and this thinning may be due to the phagocytic action of the cells of the villi. On very rare occasions tubal pregnancy terminates by rupture and abortion (Fig. 148).

Primary intraperitoneal rupture.—In this variety the rupture is so situated that the blood escapes into the belly, and inundates the recto-vaginal fossa. The embryo or mole may escape through the rent, or be detained in the tube. The blood effused may amount to two litres, or even more. Extravasations of this kind were formerly called pelvic hæmatoceles. This term could, with advantage to the student, be obliterated.

The dangers of primary intraperitoneal rupture of a gravid tube are rapid death from hæmorrhage, or death from repeated hæmorrhages. Women occasionally survive a limited hæmorrhage, and the effused blood is slowly absorbed. When the bleeding is not excessive the blood collects in the recto-vaginal fossa, and floats up the coils of intestines, and these, with the omentum, gradually form a covering to the fossa by adhering together, thus isolating the blood in the pelvis from the general peritoneal cavity. Handley has shown that when the blood slowly escapes through the rent in the tube it may occasionally become encapsuled, as frequently happens in tubal abortion. He terms this condition a *Paratubal hæmatocele*, and points out that whereas a *peritubal* hæmatocele seals the cœlomic ostium of the tube, a paratubal hæmatocele "is not necessarily inconsistent with the future functional activity of the tube." This observer is also of opinion that some of the cases described as fibroids of the Fallopian tube were probably old organised paratubal hæmatoceles. I have investigated a specimen which supports this view.

It has been pointed out (Comyns, Berkeley, and Bonney) that in some instances when the gestation sac ruptures, the effused blood forces its way between the circular and longitudinal muscular layers of the tube and forms a large space. An *intral-mural hæmatoma* of this kind may rupture through the peritoneal coat or into the tubal lumen, terminating in the latter case as a tubal abortion. In one specimen an extravasation of blood from a gestation sac lodged at the junction of the isthmus and ampulla, forced its way along the tubal wall to the cœlomic end; it then burst through the mucous membrane near the ostium.

Primary extraperitoneal rupture.—In a small proportion of cases the tube bursts in the portion of its circumference lying between the folds of the mesosalpinx. When this happens the mole and a varying amount of blood are forced between the layers of the mesometrium. As a rule, the bleeding is arrested before it assumes dangerous proportions, in consequence of the resistance which occurs when the mesometric tissues become distended. This is fortunate, for the blood and mole are entombed in the mesometrium, and rarely cause subsequent trouble. Rupture may take place, the embryo with its membranes remain uninjured, and the pregnancy continue; for, no longer confined within the narrow limits of the tube, it begins to avail itself of the additional space thus offered, and burrows, as it grows, between the layers of the mesometrium.

According to the manner in which this mode of rupture is sometimes described, it might be imagined that the tube splits and the products of gestation are suddenly discharged from the tube into the mesometrium. This is not the case, or the pregnancy would in every instance come to an end by the dissociation of the fœtal from the maternal structures. A careful study of the morbid anatomy of the accident indicates that the slow and gradual distension of the tube causes it to thin and gradually yield in that part of its circumference uncovered by peritoneum, until an opening forms, accompanied by sudden hæmorrhage which produces collapse, the profundity and duration of which depend upon the amount of blood effused. This artificial opening is gradually extended by the growing embryo and placenta as they slowly occupy the new area of connective tissue thus opened up.

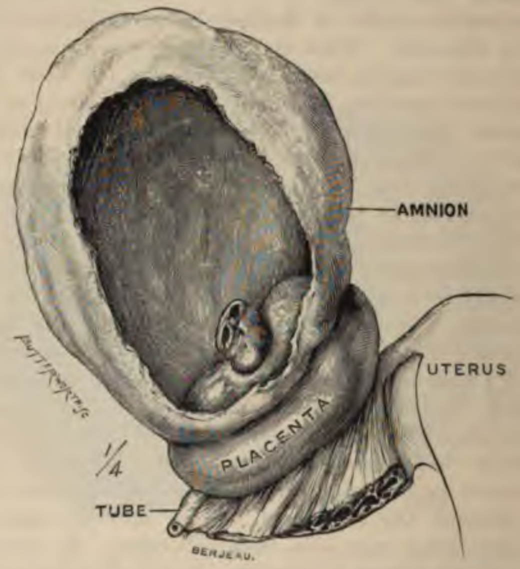

FIG. 158.—The amnion and placenta due to an oösperm which lodged in the tubal isthmus. The amnion slowly eroded the tubal wall. At term the fœtus escaped through a rent in the amnion, and disported itself among the intestines (*Trans. Obstetrical Society*, London, vol. xl. 308).

When the gestation continues in this way it is termed *Mesometric pregnancy*, because the sac is formed in part by the expanded Fallopian tube, but mainly by the peritoneum forming the mesometrium (broad ligament).

Erosion of the Tube.—It occasionally happens that an oösperm developing in the tube will slowly distend it, and gradually erode the walls of the gestation sac until the amnion protrudes into the general peritoneal cavity without any of the striking signs indicating the yielding of the tube. Gestation under these conditions may continue, and the fœtus go to term; it may then die, the amniotic fluid becomes absorbed, and the fœtus, tightly girt in its amnion, becomes mummified, or is converted into a lithopædion without invading the mesometrium.

In rarer cases the fœtus continues to live and grow; finally it emancipates itself from its amniotic prison, and moves freely about among the intestines and abdominal viscera, merely tethered by the umbilical cord (Fig. 153). For this important advance in our knowledge we are indebted to Taylor, and his observations have helped to dispel the myth that oösperms may become engrafted on the peritoneum.

The Decidua and Placenta.—In tubal gestation the placenta is liable to many vicissitudes which influence very seriously the life of the fœtus, and are such grave sources of danger to the mother that they demand great consideration from the surgeon.

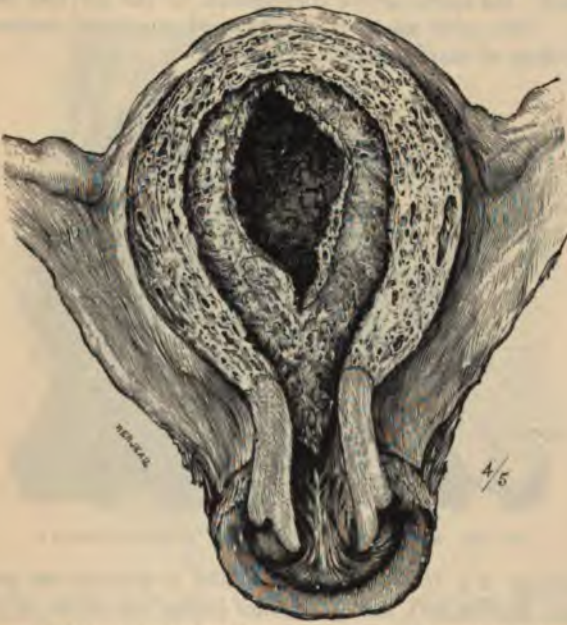

Fig. 154.—Uterus with the decidua *in situ*. From a case of tubal pregnancy.

A uterine placenta consists of fœtal and maternal elements but a tubal placenta possesses fœtal elements only (chorionic villi), for in a tubal pregnancy the decidua forms in the uterus, not in the tube: further, the tubal mucous membrane takes very little share in the formation of the placenta, and all the recent writings on the question confirm this opinion. The evidence on which the writer states that in tubal pregnancy there is no decidua in the tube is based upon a careful microscopic examination of twenty-five gravid tubes in the very early stages (four to ten weeks).

The Decidua.—In all varieties of tubal pregnancy a decidua forms in the uterine cavity; it is rarely retained until term; when it is the membrane is thrown off during the false labour characteristic of this period. More frequently the decidua is discharged in pieces during the early period of labour, or is expelled whole with signs of miscarriage. Deciduæ vary in thickness from 6 to 8 millimetre. They may be described as bags resembling in outline isosceles triangles, of which the base corresponds to the fundus of the uterus, and the apex to the internal opening of the cervical canal. At each angle of the triangle there is an opening. Those at the basal angles correspond to the Fallopian tubes, and are small; the apical orifice corresponds to the cervical canal, and is often large. The outer aspect is shaggy, and the inner surface is dotted with the orifices of uterine glands (Fig. 154).

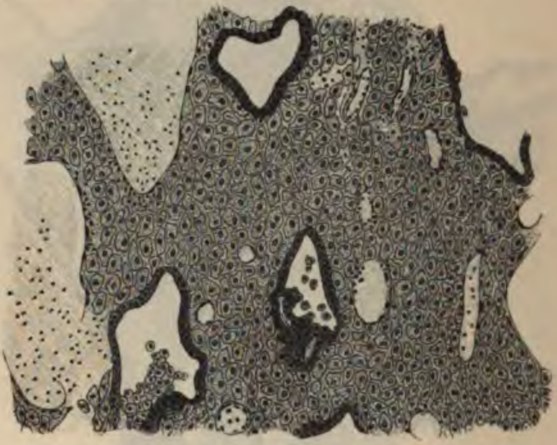

FIG. 155.—Surface section of a decidua. $\frac{100}{1}$. (After *Zweifel*.)

The *histology* of a decidua is best studied in sections cut parallel with the surface. In this way the epithelium lining the ducts of the uterine glands is well shown. The spaces not lined with epithelium are blood-vessels (Fig. 155).

It is useful, for clinical purposes, to be familiar with the microscopic characters of deciduæ, because it happens that an early uterine abortion often simulates primary rupture of a gravid tube, and *vice versa*. On examining shreds which have escaped from the vagina one is able to decide by means of the microscope whether they are fragments of decidua or chorionic villi from a uterine conception.

Placenta.—Up to the date of primary rupture the formation of the placenta has been proceeding in relation with the mucous membrane of the tube, but after this occurrence, if the disturbance is not severe enough to terminate the pregnancy, the course of events is modified in a remarkable manner, and the ultimate result is largely determined by the relative positions of the fœtus and placenta.

When the embryo is situated above the placenta the latter gradually grows and insinuates itself between the layers of the mesometrium (broad ligament) until it comes to rest upon the floor of the pelvis. Should the embryo lie below the placenta the fœtus will ultimately come to rest on the pelvic floor, and the placenta will be pushed upward by the growing fœtus (Fig. 156). This gradual disturbance leads to disastrous changes; such as repeated hæmorrhages into the placenta, which impair its functions and lead to arrest of development and death of the fœtus. A tubal fœtus, even when it survives to term, is always an unsatisfactory individual. When rescued by the surgeon these fœtuses rarely live more than a few weeks or months. (See Table, p. 639.) Many are ill-formed, and exhibit such deformities as hydrocephalus, club-foot, ectopia of the viscera, and the like. Kirchoff reported a case in which he found two embryos in a tubal sac; they measured 11 cm. in length, and were united by a band in the thoracic region (thoracopagus). The malformations of extra-uterine fœtuses have been considered with great care and detail by F. von Winckel in an admirable and exhaustive monograph containing brief descriptions of nearly one hundred examples.

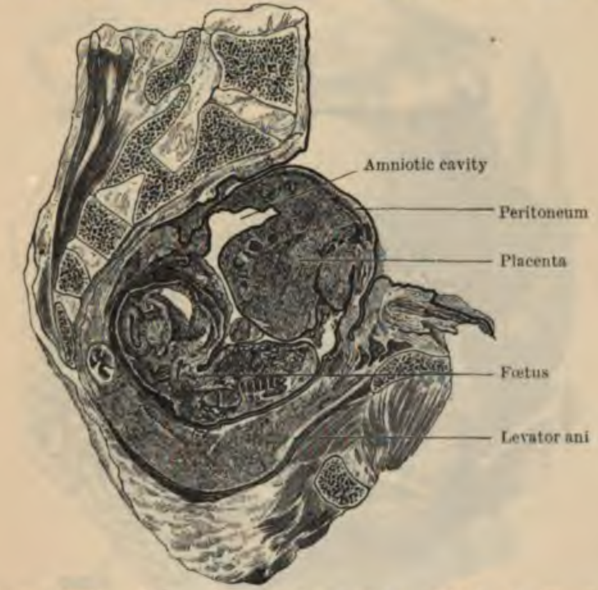

Fig. 156.—Saggital section of the pelvis of a woman with an embryo and placenta of the fourth month of gestation occupying the right mesometrium. (After *Berry Hart*.)

Should the fœtus die the placenta gradually atrophies, and in cases of lithopædion there is no trace of it.

Secondary Rupture of the Sac.—The constant tension to which the gestation sac is exposed may, if increased by a sudden hæmorrhage, lead to rupture and death. This is known as "secondary intraperitoneal rupture." Occasionally the gestation continues to term; then symptoms of labour set in, and, as delivery by the natural channels is impossible, the sac may burst into the cœlom. Escaping this, the fœtus dies, and, remaining quiescent, becomes mummified or is transformed into a lithopædion. Later the soft parts may decompose or become converted into adipocere. This peculiar white substance is chemically an ammonical soap. Its formation depends upon the presence of fat, of which there is plenty in the subcutaneous tissue of the fœtus. The encystment of a fœtus in soft and moist tissues between the layers of the mesometrium, is a condition favourable for the formation of adipocere. When fœtal tissues are converted into adipocere they adhere very tenaciously to the walls of the gestation sac. When the fœtal tissues putrefy then the pus bursts through the bladder, rectum, vagina, or abdominal wall, and fragments of fœtal tissues and bones are discharged from time to time (Fig. 157).

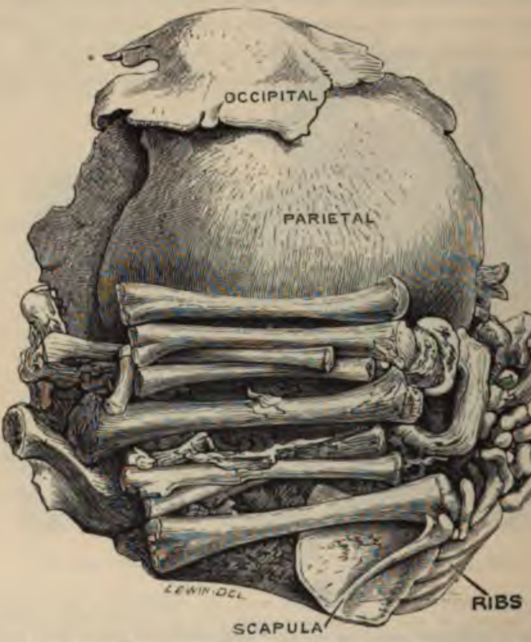

Fig. 157.—Mass of fœtal bones from a case of tubal pregnancy.

A lithopædion—that is, a fœtus whose tissues are impregnated with lime salts (calcified)—may remain quiescent many months or even fifty years, or may never cause trouble. In 1814 Cheston described a remarkable case in which an extra-uterine fœtus had been retained fifty-two years. A portion of the specimen is preserved in the Museum of the Royal College of Surgeons, England (see also Leopold's case, p. 632).

Those who are curious in this matter will find a list of cases and abstracts relating to lithopædia in Tait's well-known *Lectures*, and a larger list by Clark (*Bulletin of the Johns Hopkins Hospital*, 1897). A lithopædion is always a potential source of danger, for if pathogenic micro-organisms gain access to it, suppuration is the inevitable consequence. In a few rare instances an entire extra-uterine fœtus has been extruded by sloughing through the abdominal wall in the neighbourhood of the umbilicus (navel-delivery). In a few instances the delivery has been completed by surgeons; in one instance the fœtus was removed by a butcher; the woman recovered, and the account of this remarkable case ends in this way: "She had a navel rupture owing to the ignorance of the man in not applying a proper bandage." This is a good instance of professional bias in the apportioning of blame (*Phil. Trans.*, Abridged Edition, 1805, vol. viii. p. 517).

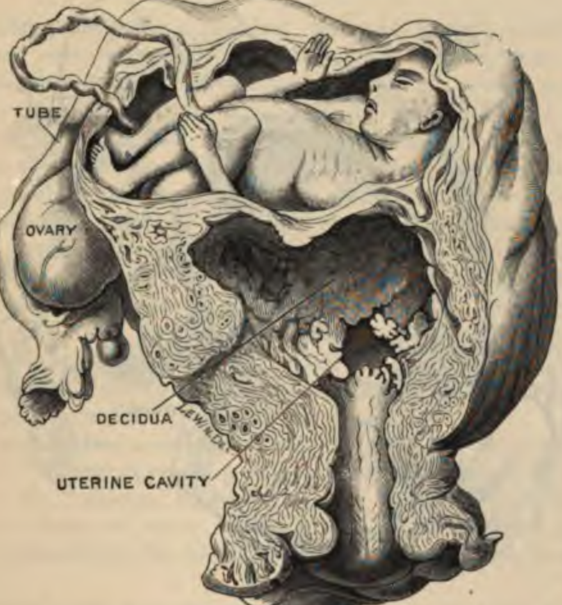

Fig. 158.—Tubo-uterine gestation. (Museum, Guy's Hospital.)

Tubo-Uterine Gestation.—When an oösperm lodges and develops in the section of the Fallopian tube which traverses the uterine wall, the gestation is termed tubo-uterine. This variety runs a somewhat different course from the purely tubal form.

Tubo-uterine gestation is somewhat rare; many specimens described as belonging to this class turn out on critical examination to be specimens of cornual pregnancy. The occurrence of tubo-uterine gestation admits of no doubt whatever; and, fortunately, a few specimens of this accident exist which demonstrate its absolute independence of cornual pregnancy. Thus the specimen represented in Fig. 158 was described in 1860 by Braxton Hicks; and another, Fig. 159, preserved in the Museum of the Royal College of Surgeons, has had the advantage of a careful investigation by Mr. Alban Doran.

Tubo-uterine gestation differs, in its course, anatomy, and modes of termination, from the purely tubal form. In tubal gestation primary rupture or abortion usually occurs about the eighth, and is rarely deferred beyond the twelfth week; in the tubo-uterine variety it may be delayed much beyond this date.

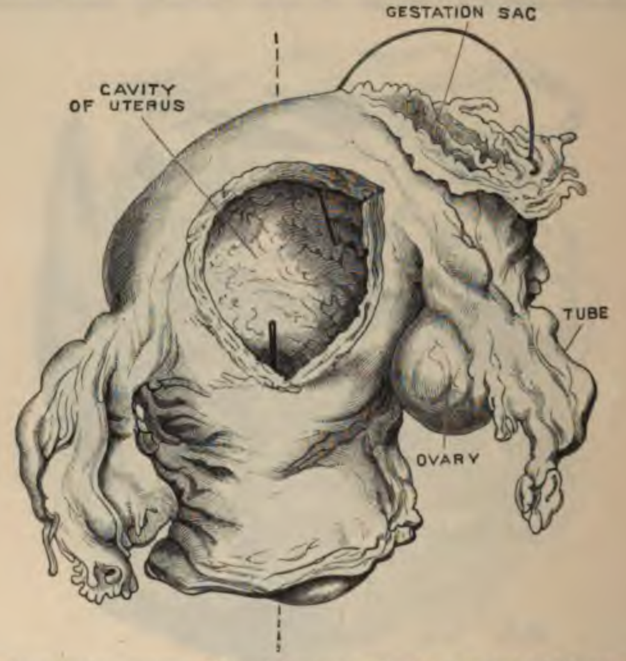

Fig. 159.—Tubo-uterine pregnancy. The gestation sac ruptured at the end of the second month. (Museum of the Royal College of Surgeons.) From a woman thirty-two years of age who died about ten hours after rupture of the gestation sac.

The sac of a tubo-uterine gestation may rupture in two directions: it may burst into the belly, and be rapidly fatal; or into the uterine cavity, and be discharged like an ordinary uterine conception.

An examination of the clinical details of cases of undoubted tubo-uterine gestation indicates that intraperitoneal rupture of the sac is more rapidly fatal than the tubal form; and that this is due to the greater amount of hæmorrhage, because not only are the walls of the gestation sac thicker, but the rent often extends to and invades the uterine wall (Fig. 159).

Although in many examples of tubo-uterine gestation primary rupture may be delayed longer than in the purely tubal form, nevertheless the sac sometimes bursts very early. In these cases death from hæmorrhage may follow within a few hours. In this form of gestation the cœlomic ostium remains patent; and I have also satisfied myself that the oösperm may undergo conversion into a mole as in the purely tubal varieties; and that rupture of the sac of a tubo-uterine gestation in the very early stages is not necessarily fatal.

CORNUAL PREGNANCY

The uterus sometimes presents the two-horned condition characteristic of many mammals, such as cows, mares, and ewes. It is well established that a two-horned uterus in women may become gravid, the pregnancy go to term, and delivery terminate as happily as in an organ of normal shape. When one horn only is gravid—and this is the usual condition—the non-gravid cornu enlarges, and a decidua is developed within it. When a woman with a two-horned uterus comes under observation in the early stages of pregnancy, and is submitted to physical examination, there is a great probability that the unilateral position of the enlarged cornu will lead to an erroneous diagnosis; and several cases have been recorded in which, under the supposition that the patient was suffering from an ovarian tumour, uterine fibroid, or tubal pregnancy, cœliotomy has been performed. In some instances the gravid half of the uterus had been amputated before the nature of the condition was appreciated.

There is, however, a variety of cornual gestation of deep interest to the surgeon. When an oösperm lodges in the rudimentary cornu of what is known as the "unicorn uterus," gestation may proceed without inconvenience for three or more months; but, as delivery by the natural passages is impossible, the ultimate results are similar to those of tubal pregnancy.

The clinical signs of gestation in the rudimentary horn of a unicorn uterus are those of tubal pregnancy; and in many instances, even during post-mortem inspection, the nature of the abnormality is overlooked.

The relation of the round ligament to the gestation sac forms a ready means of distinction between a gravid Fallopian tube and a cornual pregnancy:

(1) In a normal uterus the round ligament springs from the upper angle, immediately in front of the tube.

(2) In tubal gestation the round ligament is attached to the body of the uterus on the uterine side of the gestation sac.

(3) In cornual pregnancy the round ligament is situated on the outer side of the gestation sac.

Pregnancy in the rudimentary cornu of a unicorn uterus runs a different course to tubal pregnancy. In the case of the tube, rupture (or abortion) usually occurs before the twelfth week; whereas in the case of a rudimentary cornu the gestation may go on to full term, and then ineffectual labour leads to the death and subsequent mummification of the fœtus (in rare cases the sac may become infected and suppurate, and eventually nothing but a sequestered collection of macerated bones be left); or the gestation sac may rupture at any period from the second to the ninth month. There are good grounds for the belief that a gravid uterine cornu may rotate and twist its pedicle.

There is another feature of great importance in the anatomy of these rudimentary cornua. A fair number of specimens have been reported since Kussmaul drew attention to the anomaly in his classical work (1859); the subject has also received the attention of such observers as Mauriceau (1682), Virchow, and Turner, and in nearly all the recorded cases the gravid rudimentary cornu was attached to the well-developed cornu by a solid fleshy pedicle; even after a very minute and careful examination, the reporters have failed to detect a channel in this pedicle by means of which the gravid rudimentary cornu could communicate with the cervix of the well-formed uterine horn, or the vagina.

This of course brings into prominence the problem of the channel by which the ovum, gaining entrance into the cavity of the rudimentary cornu, becomes fertilised. The only available explanation is this: the spermatozoa reach the recto-vaginal fossa by way of the Fallopian tube attached to the well-developed half of the uterus, and fertilise the ova furnished from the ovary belonging to the rudimentary cornu. Some writers on this subject suggest that an ovum from one side may find its way into the cœlomic ostium of the opposite or rudimentary cornu, and seek to substantiate this on the ground that, in some of the cases where the rudimentary cornu was gravid, the corpus luteum of pregnancy was found in the ovary of the opposite side—that is, in the ovary corresponding to the well-developed tube.

The diagnosis of pregnancy in a rudimentary cornu is a matter of uncertainty. It is often mistaken for tubal pregnancy and for a uterine fibroid. As a matter of fact, the nature of the case has often been overlooked, even when the parts removed from the body were submitted to dissection. Nevertheless with care an accurate diagnosis is possible, as the following details show:—

In October 1902 Mr. Marsh placed under the writer's care a married woman, twenty-nine years of age, mother of two children, the youngest eighteen months old. The patient stated that she ceased to menstruate in July 1901, and subsequently passed through the usual phases of pregnancy. Three months after the last menstruation she had violent abdominal pains, and remained in bed a week. These pains recurred at irregular intervals. In April 1902 she had a loss of blood by the vagina, and for three months subsequently she had more or less daily pain, accompanied by loss of blood. After July these irregular hæmorrhages ceased, and she began to menstruate regularly; the belly, which had previously been of the size corresponding to a normal pregnancy, began to shrink, and all pain ceased. In October 1902 the patient had a swelling occupying the hypogastrium and reaching as high as the navel; it was hard, free from contraction, and dumb to auscultation; the uterus was of normal size and appeared unconnected with tumour. Both breasts yielded milk freely.

With such a history Mr. Marsh came to the conclusion that the patient was the victim of an extra-uterine gestation, or possibly conception in the rudimentary horn of a (so-called) unicorn uterus. At the operation a fœtus of full term, but dead and mummified, associated with an atrophied placenta, was found enclosed in a muscular sac representing the gravid rudimentary horn of a so-called unicorn uterus. The whole tumour was removed without difficulty, and is preserved in the Museum of the Royal College of Surgeons, London. The patient recovered. This is, as far as the writer knows, the first case in which anything approaching an accurate diagnosis of this curious condition has been made previous to operation (*Trans. of the Obstetrical Society, London*, vol. xliv. 316).

UTERO-ABDOMINAL PREGNANCY

Among the anomalous varieties of gestation it is necessary to draw attention to one of great interest as well as rarity described by Leopold in 1896. A woman, when near the mid-period of pregnancy, injured herself by slipping down the cellar steps. When she arrived at what she reckoned to be "term," extra-uterine pregnancy was diagnosed and cœliotomy performed. A fœtus of about the fourth month of gestation, enclosed in a thin amniotic sac, was found in the abdomen, and its umbilical cord passed through a rent in the back of the uterus. Subsequently the uterus with the placenta was removed with success. In this instance the uterus was injured and the fœtus in its amnion extruded into the peritoneal cavity. This is a matter of great interest, and I have endeavoured to show that many of the cases reported as examples of extra-uterine gestation in cats, bitches, rabbits, etc., are really examples of utero-abdominal pregnancy. In 1891 I drew attention to the condition, and endeavoured to explain that in many of these cases the fœtuses are too large to traverse the maternal passages; the uterus, in its violent contractions to overcome the obstruction, ruptures, and the fœtuses may be discharged into the abdomen. After the fœtus escapes the uterus rapidly contracts; hence a slit which allowed a full-sized fœtus to escape from the uterus becomes reduced to a very small opening. The majority of these accidents terminate fatally. In rare cases the mother survives, and the fœtuses in their sacs may adhere to omentum, or intestine, or they may remain free in the abdomen (Fig. 160). The amniotic fluid is absorbed, and the sac tightly contracts around the fœtus, and in its turn is often thickened by lymph deposited on it by the peritoneum.

Fœtuses found in the bellies of cats and bitches are not in any sense the result of primary abdominal pregnancy, but belong to the same category as Leopold's case, and are in reality examples of utero-abdominal pregnancy. My views in this matter have been fully confirmed by the observations of Pembry and Bellingham Smith, and by the independent work of Kamann on rabbits.

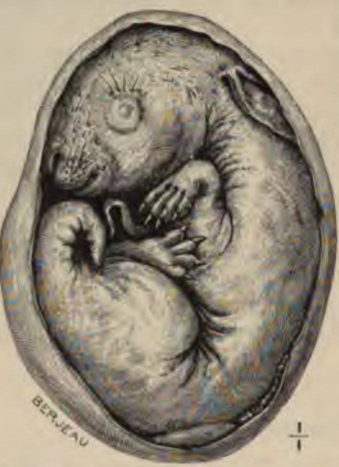

FIG. 160.—An embryo rabbit found with others free in the belly of a doe. (Museum of the Royal College of Surgeons.)

Leopold's case of utero-abdominal pregnancy is the only record of this condition in woman known to the writer of this article, but there are cases recorded in which fœtuses have been extruded from the Fallopian tube into the belly, and the examples which most resemble the condition described in rabbits have been recorded by Mendes de Leon and Pestalozza, to which reference has already been made (p. 613).

THE DIAGNOSIS OF EXTRA-UTERINE PREGNANCY

The symptoms and signs of tubal pregnancy vary considerably according to the stage to which gestation has advanced. It will be necessary, therefore, to deal with it in the following stages :—

i. Before primary rupture or abortion. ii. At the time of primary rupture or abortion. iii. From primary rupture to term. iv. After term.

Before proceeding to discuss the signs which occur during each of these stages, it is necessary to point out that the patient is sometimes aware that she is pregnant. In many cases, however, she is not aware of the fact, and the practitioner is often deceived by the absence of the usual signs of gestation, such as fulness of the breasts and amenorrhœa. The breast signs are very variable in tubal gestation; in many cases they are absent, even when the pregnancy has gone on to the fifth month; in others the signs of pregnancy are as clear and as well marked as in normal gestation. In one of my cases milk was present in one breast only, and that was on the same side as the gravid tube. Speaking generally, the absence of the usual signs of pregnancy do not negative the existence of tubal gestation; on the other hand, their presence is valuable, and may lead to a correct diagnosis. Age is of course an important feature in the diagnosis of extra-uterine pregnancy. The interval from the twenty-fifth to the thirty-fifth year is regarded as the great child-bearing period of life, and the majority of cases of tubal pregnancy fall in this period. The writer's experience teaches him that more cases occur between the twentieth and twenty-fifth year than from the thirty-fifth to the forty-first year. A dead sequestered fœtus (lithopædion) may be found at any age, at 72 (Leopold), or even 80 (Cheston).

i. *Before primary rupture.*—Gravid tubes have in many instances been removed before primary rupture or abortion; but in nearly all the instances recorded before 1891 the operations were undertaken for the purpose of removing diseased tubes; on examination of the tubes after removal the fact that they were gravid was revealed. Since this date the pathology of the early stages of tubal pregnancy has been better understood, and a clear distinction recognised between a gravid tube and a hæmatosalpinx. Accordingly many cases have been published in which a correct diagnosis was made before the operation was undertaken. This is very gratifying, for it is a matter of the utmost importance to the patient, as it spares her the awful peril which attends the rupture of the tube. The chief points in this stage are that a woman previously regular gives a definite history of a missed menstrual period; soon afterwards she suffers from pelvic pain, which induces her to seek advice; on examination an enlarged Fallopian tube is detected. If there be no history of old tubal disease, or any fact in the history of the patient suggesting septic endometritis or gonorrhœa, then the presumption is in favour of a gravid tube.

ii. *Primary rupture.*—In tubal gestation the sac ruptures, or abortion occurs, at some time before the twelfth week. The effect upon the patient depends upon the seat of rupture. When the rupture takes place between the layers of the mesometrium the symptoms will, as a rule, be less severe than when the tube bursts into the peritoneum. The pressure exercised by the blood extravasated into the tissues of the mesometrium tends to check hæmorrhage, whereas the cœlom will hold all the blood the patient possesses, and yet produce no hæmostatic effect by pressure.

The signs of intraperitoneal rupture are those characteristic of internal hæmorrhage. The patient complains of a sudden feeling as if "something had given way." This is followed by general pallor and faintness; the voice is reduced to a whisper; sighing respiration; depression of temperature; rapid and feeble pulse; usually vomiting; and in some cases death ensues in a few hours.

Should the patient recover from the shock she will sometimes state that she suspected herself to be pregnant. The symptoms of rupture are often accompanied by hæmorrhage from the vagina, and shreds of decidua will be passed, so that the case resembles in many points, and is occasionally mistaken for, early uterine abortion. Error in such circumstances may be avoided by examining the shreds discharged from the uterus; if they are found to be chorionic villi the pregnancy is clearly uterine. This simple test has been useful to me on several occasions.

The rapidity with which the rupture of a gravid tube will sometimes destroy life has caused more than one writer to describe this accident as "one of the most dreadful calamities to which women can be subjected." Indeed, it may be so rapidly fatal that many cases have been recorded in which death had been attributed to poisoning, until dissection, instituted in many instances by the coroner, revealed the true cause of death.

An analysis of many careful records and inspection of specimens of gravid tubes demonstrate that the most dangerous cases are those in which the embryo or mole is lodged in the isthmus and in the uterine portion of the tube. Death sometimes follows rupture in three or four hours.

In some of the recorded cases rupture occurred soon after the patient retired to bed, and in a few of them it seemed probable that sexual congress determined the rupture of the gestation sac.

In *extraperitoneal rupture*—that is, when the tube bursts so that the blood is extravasated between the layers of the mesometrium—the symptoms resemble intraperitoneal rupture, but, as a rule, are not so severe, and the signs of shock pass off quicker. On examining by the vagina a round, ill-defined swelling will be detected on one side of the uterus; when the effused blood is large in amount the uterus will be pushed to the opposite side. When the bleeding takes place into the left mesometrium (broad ligament), it will sometimes extend backward under the peritoneum and invade the connective tissue around the rectum, so that when the exploring finger is introduced into the rectum a semicircle—sometimes a ring—of swollen tissue will be found encircling the gut.

The escape of decidual membrane from the uterus, accompanied by blood, is also an important and fairly constant sign. Occasionally it will be necessary to pass a sound into the uterus; when the tube is gravid the cavity of this organ will be found slightly enlarged and the os invariably patulous.

The greatest difficulty in these cases is to be sure that the rupture is purely extraperitoneal. In a few cases the rupture may involve the peritoneal as well as the mesometric segment of the tube.

It is important to bear in mind that the severe disturbance which is usually set up by primary intraperitoneal rupture or abortion of a gravid tube is simulated by lesions of other abdominal viscera; for example, by perforating ulcer of the stomach, duodenum, intestine, or vermiform appendix; rupture of a pyosalpinx; acute axial rotation of an ovarian tumour or a hydrosalpinx; acute intestinal obstruction; renal colic, and biliary colic unaccompanied by jaundice. On the other hand, the profound shock which usually follows profuse internal bleeding from a gravid tube has been confounded with each of the above-mentioned lesions. In one case a woman was submitted to operation for supposed strangulated inguinal hernia. The sac was found filled with blood; the parietes were freely incised and a gravid tube which had burst was found and excised (Malherbe).

iii. *From primary rupture to term.*—From the third month onwards the leading signs of extra-uterine gestation may be summarised thus:—Amenorrhœa is occasionally found; frequently there is hæmorrhage from the uterus, occurring at irregular intervals, accompanied by the escape of decidual membrane. This is a valuable diagnostic sign when associated with the physical signs of a tumour outside the uterus. It is even more valuable if the patient has missed one or two periods. There may or may not be milk in the breasts; its presence is a valuable indication. From its absence nothing to the point can be inferred. The uterus is slightly enlarged; the os is usually soft, as in normal pregnancy, and patulous. A large and gradually increasing swelling exists to one side of and behind the uterus. Occasionally the fœtal heart can be heard, and in advanced cases the outlines of the fœtus may be distinguished.

When a woman in whom the existence of tubal gestation is suspected is suddenly seized with collapse and all the signs of internal bleeding, it is indicative of rupture of the gestation sac.

Tubal pregnancy is very apt to occur after long intervals of sterility.

iv. *After term.*—In spite of all the risks that beset the life of a tubal fœtus and that of its mother, the pregnancy may go to term in some instances; and its course is so regular and uneventful that it is not suspected to be abnormal. Then a remarkable series of events ensues.

(*a*) Paroxysmal abdominal pains come on, resembling those of natural labour, accompanied by a discharge from the uterus of blood and mucus resembling the "show," and the os uteri dilates.

(*b*) This unavailing labour may last a few hours or days (it is stated to have lasted for weeks in some patients), and then subside.

(*c*) The mammæ may continue to secrete milk for several weeks.

These signs sometimes pass away, the amniotic fluid is absorbed, the swelling diminishes in size, and the retained fœtus causes no trouble. In the majority of cases, however, suppuration takes place in the sac, the fœtus decomposes, and the fragments of its tissues are discharged through sinuses in the groin, abdomen, vagina, or bladder. It should be remembered that the onset of labour may rupture the sac.

Various conditions may complicate the diagnosis of tubal pregnancy, thus:—

1. Uterine and tubal pregnancy are sometimes concurrent; 2. Tubal pregnancy may be repeated; 3. Tubal pregnancy may be bilateral.

Each of these conditions demands consideration; and it is also important to bear in mind that tubal pregnancy may be simulated by a variety of conditions:—

Uterine pregnancy, especially where the walls of the pregnant uterus are unusually thin, allowing the fœtus to be felt with uncommon distinctness; Pregnancy in a two-horned uterus; Retroversion of the gravid uterus; Ovarian tumours; Tumours of the mesometrium; Uterine fibroids; Fæces in the rectum; *A gravid Fallopian tube often simulates a uterine fibroid;* Pregnancy in a rudimentary uterine cornu often simulates a fibroid. It is necessary to mention that these conditions may complicate, as well as simulate, extra-uterine pregnancy in all its varieties and stages.

TWIN TUBAL PREGNANCY

A few writers on extra-uterine pregnancy, Parry especially, deal with this subject as if it were a common event. A critical study of Parry's book shows clearly that he confounded three distinct conditions:—1. Concurrent uterine and tubal pregnancy; 2. Uterine subsequent to tubal pregnancy; 3. Twin gestation in a Fallopian tube. In a communication to the *Obstetrical and Gynæcological Society* of Vienna, April 1904, Schauta reported a case in which he had removed a gravid right Fallopian tube, and on examination it was found to contain two "moles" of different ages. He stated that he had found records of nineteen similar cases.

1. **Concurrent uterine and tubal pregnancy.** — This condition requires consideration in three sections:—

(*a*) A tubal and a uterine pregnancy occur simultaneously; the complication is recognised in the early months, and terminated by surgical intervention.

(*b*) Intra- and extra-uterine pregnancy with living fœtuses run concurrently to term.

(*c*) Cases in which uterine pregnancy is complicated by the presence in the pelvis of a quiescent (sequestrated) extra-uterine fœtus.

Tubal and uterine pregnancy coexist, but the complication is recognised in the early stages.

It is now established by many carefully recorded cases that pregnancy may coexist in the Fallopian tube and uterus, but the tubal oosperm becomes converted into a mole, and whilst the uterine oosperm continues its normal development, its tubal companion may cause trouble by inducing rupture of the tube or tubal abortion. The period at which these accidents arise in the course of the pregnancy varies greatly. In some of the cases the catastrophe to the tubal pregnancy arises so early after fertilisation that the intra-uterine pregnancy is not recognised at first, the enlargement of the uterus being attributed to the coincident formation of the decidua. The true condition is revealed in the subsequent course of the case, or is discovered at the operation (Boyd, Zincke, Simpson, Strauss, etc.). In some instances the conversion of the tubal oosperm into a mole has occurred so quietly that its presence has not been suspected until after miscarriage of the uterine pregnancy; then a swelling has been recognised in the pelvis, and its nature determined in the course of an operation (Phillips).

The cases of concurrent tubal and uterine pregnancy in which the tubal pregnancy is represented by a mole have been but rarely diagnosed. Now attention has been aroused in regard to this matter, we may expect to have some of these cases recognised clinically, for the number of examples recorded in gynæcological and obstetrical literature during the last decade shows that it is no uncommon condition; and it interests the writer greatly to find that the tubal mole, which is the criterion of tubal pregnancy in the absence of a recognisable embryo or fœtus, has contributed in no small measure to this advance in accurate clinical observation. A study of the records of this variety of concurrent uterine and tubal pregnancy indicates that, when the condition is clearly recognised, the gravid tube should be treated on the same lines as in the uncomplicated variety of tubal pregnancy; namely, by its removal by surgical intervention without unnecessary delay, and in a fair proportion of cases the uterus will tolerate the interference and the uterine pregnancy will continue safely to term.

In some instances surgical interference has not been attended with success. Thus in the case reported by Strauss the patient aborted three weeks after the operation on the gravid tube; then the pelvic veins thrombosed and she died about six weeks after the miscarriage with the signs of pulmonary embolism. But in other cases operation has been followed by brilliant results, for the uterine pregnancy has not only gone to term, and the patients become the happy mothers of living children, but in one case the patient reconceived and had a successful pregnancy (Boyd). The case reported by Mrs. Boyd is interesting from the fact that the patient's husband (an artisan) had read my account of tubal pregnancy, and when he applied to have his wife admitted to the hospital, stated that he suspected she had a tubal pregnancy which had burst.

Walther reported a case which shows what curious combinations may arise in "compound pregnancy." In his patient the left Fallopian tube contained a mole and was successfully removed. Three days later the patient aborted, and careful examination of the uterus showed that this organ was double and of the variety *subseptus*; the right horn contained a placenta and the left a well-developed decidua.

Uterine and extra-uterine pregnancy running concurrently to term.

It is too true that uterine and tubal pregnancy may run concurrently and both go to term; this may be described as the most dangerous combination to which child-bearing women are liable.

In order to show what a disastrous conjunction a combined intra- and extra-uterine pregnancy is at term, with two "quick" children, I have drawn up a table of records which plainly shows how deadly it is for the mothers; and it also sets forth the fate of the children. To these cases the year of record has been added, and it will be seen with satisfaction how rarely this deadly combination runs to term. One bright feature is disclosed in this table, and that is the good fortune which fell to Ludwig, who not only had the satisfaction of saving the life of the mother, but the intra- and the extra-uterine children were successfully rescued, a feat in surgery of which any man may justly feel proud. Mathewson's case is remarkable, especially from the treatment employed. The patient was thirty-eight years of age; at her third confinement in 1894 Mathewson noticed a lump in the left side of the abdomen; two days later he noticed that it moved spontaneously, and then realised that it was an extra-uterine fœtus. At a consultation it was decided to try the effect of withdrawing the liquor amnii through a trocar, and the physicians forced a stilette deeply into the thorax of the fœtus. From that time its movements ceased and it gave no further trouble. The patient had two subsequent confinements without difficulty; in 1898 the "lump" had shrunk, and was movable, but caused no trouble.

Table showing Cases of Concurrent Intra- and Extra-Uterine Pregnancy (Compound Pregnancy) running to term, with the Fate of the Mother and Children.

Recorder.	Year.	Fate of Mother.	Intra-Uterine Child.	Extra-Uterine Child.
Cooke	1863	Died	Died	Died
Sale	1871	Died	Lived	Lived
Galabin	1881	Died	Died	Died
Wilson	1880	Died	Died	Lived
Franklin	1893	Died	Lived	Died
Ludwig	1896	Lived	Lived	Lived
Mathewson	1894	Lived	Lived	Killed

Uterine pregnancy complicated by a sequestered extra-uterine pregnancy. Some very carefully described examples of this rare condition are known. Leopold has recorded a very remarkable case concerning a woman who had seven children. After the fourth child she had, according to the evidence, an extra-uterine pregnancy, then three more intra-uterine children, and lived to the age of seventy years; at the necropsy a sequestered fœtus, which she had carried thirty-five years, was found. This case, and others which could be quoted, if necessary, serves to show that a sequestered fœtus is not necessarily an impassable barrier to the child. Stonham, whilst conducting an autopsy on a woman forty-three years of age, who died in the seventh month of her pregnancy from bronchitis and ulceration of the trachea, found a fœtus (enclosed in a thick membrane) in the right mesometrium. Some of the bones were completely macerated; the soft structures were soapy in consistence. There was a thin deposit of calcareous material on the inner wall of the cyst. The left mesometrium was normal. The uterus contained a seven months' fœtus, which was apparently living at the mother's death, since it showed no signs of maceration.

Worrall, of Sydney, published details of a case in which a woman with a fœtus in the mesometrium subsequently conceived in the uterus. The nature of the case was correctly diagnosed, and an operation for the relief of the condition was successfully carried out. The patient was thirty years of age, and mother of five children. In April 1888, the menses having been absent six weeks, she was seized in the night with severe abdominal pains, faintness, and vomiting. She was confined to her bed six weeks. In October of the same year, at about the eighth month of gestation, a sudden flooding, unaccompanied by pain, came on, and lasted three days. A month later she was seized with severe abdominal pains, which lasted a fortnight; she then began to decrease in size, and menstruation reappeared. The tumour decreased to a certain point, and then remained stationary. After July 1889 she ceased to menstruate, and her abdomen gradually enlarged. A few months later

Dr. Worrall was consulted, and he correctly diagnosed the existence of a living intra-uterine fœtus and an extra-uterine fœtus which had been dead about two years. Acting on this diagnosis, he removed the extra-uterine fœtus from the left mesometrium. It was not decomposed, but was very flaccid, and weighed 4½ lbs. The placenta was left and the sac drained. Next day labour came on, and the intra-uterine child was born. It was a female, and cried feebly, "but, in spite of every care, died in a few hours." The patient made a good recovery.

The history of some of these cases of "compound pregnancy," to use Simpson's phrase, shows that a sequestered fœtus (lithopædion) may constitute a dangerous barrier to the transit of the uterine fœtus.

2. **Repeated tubal pregnancy.**—In 1885 Lawson Tait operated on a woman twenty-five years of age, and removed a gestation sac with the fœtus and placenta from the right side of the pelvis. This woman recovered, and eighteen months later was confined at term. Fifteen months after delivery she conceived again, and when, according to her reckoning, she had advanced to the fourth month, she was seized with severe abdominal pain, and died in five hours. At the post-mortem examination a tubo-uterine gestation was found on the left side. Since this date a number of examples of this double accident have been recorded, and on evidence equally secure. It is also remarkable that in some of the patients the second tube became pregnant within a few weeks of their recovery from the operation necessitated by the conception in its fellow. This last statement is based on the careful report of a case by Zangemeister. On August 11, 1897, he operated on a woman thirty-nine years of age, and removed the left Fallopian tube, which contained a fœtus 20 cm. in length. The patient made an afebrile recovery, and left the Klinik August 31, 1897. She was readmitted February 1, 1898, and again submitted to cœliotomy; a fœtus 16 cm. in length was removed with the right Fallopian tube and a large amount of clot. Unfortunately she died a few hours after the operation. The clinical facts make it clear that she conceived in the right tube a few weeks after leaving the Klinik.

With our present knowledge it may be stated that the period of liability to repeated tubal pregnancy may vary from seven weeks to nine years, but the greater proportion of the cases fall within a limit of four years from the date of the first tube becoming gravid. This conclusion is well borne out by a study of Vassmer's painstaking analysis of 132 cases of repeated tubal pregnancy. From a careful study of available records I think the liability to repeated tubal pregnancy may be estimated at 5 per cent.

It also seems probable, but it has by no means been established, that a woman may conceive in a Fallopian tube, and an abortion occur at an early date without causing the patient much distress, and she may reconceive in the same tube.

3. **Bilateral tubal pregnancy.**—In the preceding section it was shown that pregnancy may occur in one tube and at a subsequent date in the other. This is in a sense bilateral tubal pregnancy, but it is

better to limit the term to the condition where a tubal pregnancy, the result of simultaneous or nearly simultaneous conception, is progressing in both tubes at the same time. A number of cases has been reported in which two gravid tubes have been removed from a patient at the same operation; but a critical examination has shown them to be of different dates, one of them progressing, the other old and quiescent. Such are, as a matter of fact, examples of repeated tubal pregnancy.

Jayle and Nandrot have recently made a careful study of this question, and from a critical analysis of twenty-nine cases recorded as examples of bilateral tubal pregnancy they make the following deductions :—

The diagnosis of bilateral tubal pregnancy may be made in some cases, although in others it is impossible. *The patient is usually a multipara.* There is no evidence in the records that conception was simultaneous in the two tubes, nor that the pregnancies developed together. Weinlechner mentioned at the *Obstetrical and Gynæcological Society* of Vienna, 1904, the case of a woman, aged 35 years, in whom he found bilateral tubal pregnancy, and each gestation sac had burst and was freely bleeding. The subsequent examination of the tubes and the moles supported the view that the pregnancies were practically simultaneous. The question of bilateral simultaneous tubal conception will remain unsettled in many minds until a case is found in which the two embryos are living and of the same age. It is probably the rarest of all varieties or combinations of tubal pregnancy.

Normal pregnancy.—This has been mistaken for tubal pregnancy. The abdomen has been opened, the fœtus extracted, and the uterus amputated before the error was discovered.

Pregnancy in one horn of a two-horned uterus.—A few cases are known in which this anomaly has led to grave difficulty in diagnosis and to error in treatment. Pregnancy in the ill-developed horn of the so-called "unicorn" uterus requires the same treatment as tubal pregnancy.

Abnormal thinness of the walls of a gravid uterus.—Lawson Tait has drawn attention to some cases which had fallen under his notice, in which the walls of the uterus were of such extreme thinness that the fœtus could be easily felt. And in reference to one case he writes: "The child could be felt with the most astonishing distinctness, and it floated about as if it were perfectly free in the abdomen." There is also a reference to a similar condition in Parry's well-known work. That this is a condition to bear in mind, the following case, furnished me by a surgeon, well illustrates :—

A woman, twenty-nine years of age, was admitted into the infirmary in such an anæmic and emaciated condition that she was too weak to stand. There was vomiting, amenorrhœa of six months' standing, pigmentation along the linea alba, and milk in the breasts. The belly was distended, and in the right iliac fossa was lodged a crescentic mass not unlike a fœtus in outline, and so mobile that it could be pushed into the right iliac fossa. The remarkable ease with which this body could be grasped, and its position when at rest, led to the diagnosis of extra-uterine pregnancy, and an operation was decided upon. On incising the peritoneum a smooth glistening body of a pearly grey colour, exactly like an ovarian cyst, was seen, but it had the shape and occupied the position of the uterus. The fœtus could be felt and pushed about in the fluid with ease. The wound was closed at once. Miscarriage took place on the third day. The woman recovered.

Retroversion of the gravid uterus has been a source of error. Retention of urine, so characteristic of this condition, is occasionally produced when the embryo occupies the mesometrium, accompanied by much hæmorrhage. On the other hand, extra-uterine gestation has been mistaken for retroversion of a gravid uterus. The diagnosis of extra-uterine gestation is occasionally complicated by the presence of parovarian cysts, ovarian tumours, and uterine fibroids.

THE TREATMENT OF EXTRA-UTERINE GESTATION

This may be of two kinds: (*a*) Expectant, (*b*) Operative.

Expectant treatment.—This is only possible in the early stages of tubal pregnancy, and is a survival of the period when collections of blood in the female pelvis were commonly called hæmatoceles, and their causes ill-understood: it was then the custom to keep women with intrapelvic hæmorrhage at rest in bed for many weeks, in some cases many months, till the blood was absorbed. In some cases suppuration occurred, and the pus discharged itself through the rectum, vagina, bladder, or slowly through the abdominal wall; the final evacuation being occasionally hastened by the scalpel. Some practitioners advocate this mode of treatment at the present time. It is undeniable that with absolute rest in bed a very large effusion of blood will be slowly absorbed; at the same time no one will deny that acute symptoms, indicated by rapidity of pulse, a high temperature, and occasionally by toxic symptoms, arise from the absorption of liquefying non-septic clot. Many cases, too, have been reported to show that a deliquescent mole in a Fallopian tube is apt to be a very troublesome body quite apart from its tendency to provoke recurrent bleeding from the tube. Further, many patients who have been treated on the expectant plan, and who have been regarded as cured, have subsequently come under the care of surgeons for operative treatment. In some of these a liquefying mole has been found, and in others a large encysted collection of sanguineous fluid.

On the whole it may be fairly stated that probably many gravid tubes rupture or abort, especially the latter, and cause the patient no more than a moderate amount of disturbance which rest will cure. There remains, however, a very large number in which operation is directly needed to save the patient from bleeding to death. In a fair proportion of cases it can be said that though life was not directly imperilled, operative interference was nevertheless directly serviceable in reducing convalescence from several months to a few weeks.

Operative treatment.—The admirable results which have followed the surgical treatment of extra-uterine gestation have served to place this method on as secure a foundation as ovariotomy. The risks and difficulties depend mainly on the extent to which the gestation has advanced at the time the operation is performed. The operative treatment may be considered in the following stages:—

i. Before primary rupture or abortion. ii. At the time of primary rupture. iii. Subsequent to rupture. iv. When the embryo and placenta occupy the mesometrium. The fourth stage must be considered in sections, thus: (*a*) At or near term, the child being alive. (*b*) At, near, or after term, the child being dead, mummified, or reduced to a *lithopædion.* (*c*) After decomposition of the fœtus and suppuration in the sac.

i. *Before primary rupture or abortion.*—Opportunities of dealing with cases in this stage are uncommon, as gravid tubes rarely cause trouble before they rupture or abort. When the evidence is convincing, cœliotomy should be performed without delay.

ii. *At the time of primary rupture or abortion.*—The majority of cases of tubal pregnancy come under observation at the time of primary rupture or abortion, and this is usually some period between the fourth and twelfth weeks.

When the symptoms of hæmorrhage are unmistakable and the patient's life in grave danger, cœliotomy should be performed without delay, unless there be good evidence that the rupture is extraperitoneal. The employment of this method is in strict accordance with the canon of surgery, valid in other regions of the body, namely, to arrest hæmorrhage at the earliest possible moment.

There are few accidents that test the skill, nerve, and resource of a surgeon more than cœliotomy for a suspected intraperitoneal rupture of a gravid tube, and few operations are followed by such brilliant results. The method of performing the operation before and at the time of primary rupture is identical with oophorectomy. Occasionally the rent in the tube may extend to the fundus of the uterus, especially if the embryo be lodged near the uterus. Such rents should be carefully sutured with silk. In a few exceptional instances experienced surgeons have been obliged to remove the uterus in order to control the hæmorrhage.

iii. *After primary rupture.*—Cases are submitted to operation at periods varying from a few days to weeks or even months after the tube has ruptured. It has been pointed out already that in an exceedingly large proportion of these cases the tube is occupied by a mole.

When the tube bursts the hæmorrhage may not be so profuse as to be fatal, and the patient, recovering from the shock, may not manifest such grave symptoms as to make surgical aid obviously necessary. The consequence is that the patient remains for several weeks under expectant treatment (unless a renewal of bleeding kill her). At last surgical aid is sought, and a discovery of the true nature of the case leads to cœliotomy. In such cases, when the abdomen is opened, the clots are removed, the free blood is easily sponged out, and the damaged tube and ovary are removed as in oophorectomy. When much free blood exists in the peritoneal cavity, care must be taken that no clots are allowed to remain in the iliac fossa. When blood has remained in the peritoneal cavity for several weeks after rupture it is sometimes necessary to drain.

The cases in which abortion or rupture of gravid tubes gives rise to intraperitoneal bleeding, moderate in amount and insufficient to cause symptoms which directly threaten life, are those in which the effused blood is confined to the cavity of the pelvis by adhesions of intestines and omentum, or encapsuled (peritubal hæmatocele), as explained in the section dealing with primary intraperitoneal rupture. Experience has not yet decided whether under such conditions it is safer for the patient to run the risks of immediate operation or to wait for a few weeks in order to ascertain if absorption will occur. At present, I believe the patient's interests are best served by allowing her to recover from the shock, and then dealing with the damaged tube by cœliotomy.

In an operation for the removal of a gravid tube it has been often suggested that the opposite Fallopian tube should be removed also to protect the patient against recurrence of the accident; but men of ripe experience and sound judgment are averse to such a proceeding, for it is an established fact that uterine pregnancy is not uncommon after unilateral tubal gestation, and my own experience is in harmony with this.

Colpotomy.—A large number of cases have been reported in which the mole and blood-clot have been removed from the pelvis through an incision in the posterior cul-de-sac of the vagina; this is known as posterior colpotomy. The recovery is usually speedy, and this mode of operating avoids the risk of a yielding abdominal scar. Bröse has reported a series of twenty-five successful cases by this method.

iv. *Broad ligament (Mesometric) gestation.*—When the tube bursts between the layers of the mesometrium immediate operative interference is rarely necessary. In a small proportion of cases the embryo survives the accident and continues to grow. At any date from this period up to term, surgical interference may be called for to save the patient from the disastrous effects of secondary intraperitoneal rupture. When gestation has not advanced beyond the fourth month, it is occasionally possible to remove the embryo, tube, ovary, and adjacent portion of the mesometrium with the placenta, and thoroughly to remove all blood-clot. When gestation has advanced beyond the fourth month, the placenta has become too large to be dealt with in this summary manner; at the same time the sac has encroached upon the peritoneum belonging to adjacent organs, such as uterus and rectum, bladder, and not infrequently the anterior wall of the abdomen.

After the fifth month operative measures for tubal gestation must be considered under two headings:—

(1) *The treatment of the sac*; (2) *the treatment of the placenta.*

(1) *The Treatment of the Sac.*—The gestation sac in the last stages of tubal pregnancy consists of the remnants of the expanded tube and the

mesometrium, which may be thickened in some parts and expanded in others. To the walls of the sac coils of intestine and omentum usually adhere. Experience has decided clearly enough that the safest plan is to incise the sac, remove the fœtus, and stitch the edges of the sac to the abdominal wound, precisely as in the plan recommended after enucleating large cysts and tumours from between the layers of the mesometrium. In those rare cases where the amnion erodes the tube and invades the belly (ventral pregnancy), the gestation sac with its contents has been successfully removed by merely transfixing its base with silk ligatures.

(2) *The Treatment of the Placenta.*—The rules for the treatment of the placenta may be formulated thus:—

(1) When the placenta is situated above the fœtus it is good practice to attempt its removal.

(2) In some instances the placenta becomes detached in the course of the operation, and leaves no choice.

(3) When the placenta is below the fœtus it may be left.

(4) Should the placenta be left, the sac closed, and symptoms of suppuration occur, the wound must be reopened and the placenta removed.

(5) If the fœtus dies some weeks before the operation is attempted the placenta can be removed with little risk of hæmorrhage.

The great risk of violent hæmorrhage renders an operation for tubal pregnancy with a quick placenta, between the fifth and ninth months of gestation, the most dangerous in the whole range of surgery. About two-thirds of the patients die (see Table). There are three great dangers—hæmorrhage, shock, and peritonitis, due to decomposition of the placenta when it has been left to slough; hence it cannot be urged with too much force that when it is fairly evident that a woman has a tubal pregnancy it should be dealt with by operation without delay; and my experience of the operation leads me to believe that it is a wise plan to remove the placenta at the primary operation.

In order to show how rarely an extra-uterine fœtus survives many weeks its extraction, reference may be made to the subjoined table. The cases in this table also serve to show what great risk a woman runs when it is necessary to perform cœliotomy for the removal of a living extra-uterine child. Fortunately very few extra-uterine fœtuses survive to term.

[TABLE

Table showing the Risks to Mother and Child of Cœliotomy performed between the 7th and 9th Months of Extra-Uterine Gestation, the Child being alive.

Operator.	Date of Pregnancy.	Treatment of Placenta.	Result to		Reference.
			Mother.	Child.	
Heywood Smith	36 wks.	Removed	D.	Lived 30 mins.	*Trans. Obstet. Soc.* vol. xx. p. 5
Jessop	33 wks.	Left to slough	R.	Lived 11 months	*Trans. Obstet. Soc.* vol. xviii. p. 261
Gervis	Term	Left to slough	D.	Lived 6 hours	*Ibid.* 1877, vol. ii. p. 884
Champneys	28 wks.	Left to slough	D.	Lived a few hours	*Trans. Obstet. Soc.* vol. xxix. p. 456
J. Williams	34 wks.	Left to slough	R.	Lived a few hours	*Ibid.* vol. xxix. p. 482
Taylor	Term	Left	R.	Lived 5 months	*Ibid.* vol. xxxiii. p. 115
Stevenson	32 wks.	Removed	R.	Lived 2 days	*Ibid.* vol. xxxv. p. 176
Pearce Gould	32 wks.	Left	D.	Lived a few mins.	*Middlesex Hosp. Rep.* 1890, p. 175
Handfield-Jones	32 wks.	Left	D.	Lived ?3 months	*Lancet*, 1895, vol. ii. p. 972
Galabin	Term	...	D.	Lived a few mins.	*Trans. Obstet. Soc.* vol. xxxv. p. 182
Donald	Term	Removed	D.	Never breathed	Unpublished
Cullingworth	Term	Left	D.	Lived 11 months	*Brit. Med. Journ.* 1894, vol. ii. p. 1422
Bland-Sutton	Term	Removed	R.	Lived 2 hours	*Trans. Obstet. Soc.* vol. xl. p. 308

Hysterectomy in cases of extra-uterine pregnancy.—It is occasionally necessary in three of the great subdivisions of abnormal gestation embraced under this heading, namely, tubal, interstitial, and cornual pregnancy, to remove the uterus in order efficiently to control the bleeding, or for other reasons. In tubal pregnancy such a necessity rarely arises, but cases have been observed and recorded in which the hæmorrhage has torn up the tissues of the mesometrium, so that an experienced and conservative surgeon like Doran has found this step imperative, and I have had a similar experience.

In cases of interstitial or tubo-uterine pregnancy, in which gestation has gone beyond the second month, the uterine tissues are so intimately incorporated with the gestation sac that the operator who is called upon to deal with hæmorrhage due to rupture of the sac will find it in the majority of cases the only expedient open to him.

In the condition known as "pregnancy in the rudimentary horn of a so-called unicorn uterus," or better "cornual pregnancy," the removal of the uterus is often necessary, not only in those cases where operation is urgently indicated on the score of bleeding in cases where the fœtus is quick, but also in the other variety in which the fœtus is dead and sequestrated, and in the rare instances in which the fœtus has undergone maceration, and only its skeleton remains (Remfrey). There is a condition of cornual pregnancy in which the fully-developed cornu may be spared, namely, that in which the rudimentary but gravid cornu is connected with it by a distinct and usually solid "pedicle." Many such have been observed and very carefully described (see p. 624).

After death of the fœtus at or near term.—Operations after the death of the fœtus are less complicated than when it is alive and the placental circulation in full vigour. Not only is the proceeding simplified from the operative point of view, but the results, in so far as the mother is concerned, are also much more satisfactory.

When the operation is undertaken in cases where the fœtus is in the state of *lithopædion* the procedure is very simple, because the placenta has completely disappeared. There is a circumstance in connection with a fœtus wholly or partially converted into *adipocere*, which is of some importance to the surgeon, namely, that the tissues have a strong tendency to adhere to the walls of the sac. This is especially marked in connection with the hairy scalp.

After decomposition of the fœtus and suppuration of the sac.—After death and decomposition of the fœtus, fistulæ form, by which pus, accompanied by fragments of fœtal tissue and bones, finds an exit; either through the rectum, vagina, bladder, uterus, or at some spot in the anterior abdominal wall below the umbilicus. The treatment in such cases is simplicity itself. The sinuses should be dilated, and all fragments removed from the cavity in which they lie. When this is done thoroughly the sinuses will rapidly granulate and close. Partial operations are useless; if but a bit of a bone be allowed to remain, a troublesome fistula will persist.

Results of operative treatment.—In order to afford some notion of the risks attending the surgical treatment of extra-uterine gestation, as well as to give an idea of its relative frequency in hospital practice, the following figures will serve. From 1896 to 1904, both years inclusive, 82 operations for this condition were performed in the Chelsea Hospital for Women. During this period all the varieties of tubal pregnancy were met with (ampullary, isthmial, and tubo-uterine), including the rare condition of a living fœtus free among the intestines, and the more uncommon condition of a full-time cornual pregnancy. Of these 82 patients two died from the operation, one in 1897 and the other in 1902.

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DISEASES OF THE FEMALE BLADDER AND URETHRA

MORBID conditions of the lower urinary organs in the female, as in the male, chiefly show themselves in pain and frequency in micturition. In a large number of these cases the manifestations depend upon the presence of cystitis in a more or less severe degree; and it is a point of first importance to determine whether cystitis be present, or only some condition resembling it in its more prominent features of pain and frequency of micturition and the presence of pus and blood in the urine: it is important, in the next place, if it be cystitis, to determine on what local or remote cause it depends.

DISEASES OF THE URETHRA.—The morbid conditions met with in the female urethra are but few.

Developmental defects: these are, (i.) Entire absence of urethra; (ii.) Hypospadias; (iii.) Deficiency of internal portion; (iv.) Atresia of the urethra (congenital).

Displacement: this occurs chiefly as longitudinal traction by displacement upwards of the bladder; it causes frequency of micturition.

Neoplasms: such as papilloma and polypi of the mucous membrane; they may cause some obstruction without much local tenderness; in rare instances sarcoma and carcinoma are met with, but the most common neoplasm is the *vascular growth or urethral caruncle*. The urethral caruncle consists of dilated capillaries in connective tissue covered with squamous epithelium, which form a small bright red tender and vascular tumour at the urethral orifice. The symptoms are pains on micturition or coitus, sometimes retention of urine. The most effective mode of treatment is to destroy the prominence with the actual cautery, care being taken to arrest subsequent bleeding, if any occurs, by plugging with a catheter and pressure with an elastic compress and a perineal band.

Cysts and Abscesses.—Cysts containing clear mucoid fluid or pus are occasionally met with in the urethro-vaginal septum; they are due to dilatation and inflammation of Skene's glands, which are situated near the mouth of the urethra. Bartholin's glands (corresponding to Cowper's glands in the male) are sometimes the seat of inflammation, suppuration, or neoplasms. Enlarged acinous mucous glands are sometimes found near the external urethral orifice. Treatment, when any is called for, should be excision of the cyst, taking care to remove the whole of its walls.

Urethritis is usually associated with gonorrhœa. The urethra is swollen and tender, and yields pus when pressed upon through the anterior vaginal wall. The most effective treatment is to give diluent drinks and copaiba, locally to use iodoform bougies, and counter irritation by painting the anterior wall of the vagina with tincture of iodine.

Urethral bougies containing silver nitrate, or some other astringent, and a sedative drug are in favour with some surgeons.

Dilatation sometimes occurs as a result of coitus when the vagina is occluded or over-distended. This very rare condition is to be remedied by burning a longitudinal furrow by the actual cautery with the aid of a grooved speculum.

Tuberculous disease sometimes begins in the female urethra, and when present frequently causes pain, incontinence of urine, hæmaturia, or pyuria.

ABNORMALITIES OF THE BLADDER.—**The congenital or acquired defects** of the bladder are malposition, supernumerary bladders, absence, and ecstrophy. When both the ureters terminate in some abnormal place, *e.g.* by the side of the meatus or in the vagina, the bladder may be, but is not invariably absent.

The bladder may be protruded in a hernial form when the linea alba is weak or deficient, or when the expansion of the oblique muscles of the abdomen is absent. If the whole of the front wall of the abdomen is deficient in the hypogastrium, and the bladder properly developed, the bladder will protrude at the opening. This is not the same thing as ecstrophy. In most of the cases of protrusion or displacement of the bladder the condition is not congenital but acquired.

Displacement—Hernia.—Owing to its loose attachment to the wall of the pelvis the bladder in woman is readily displaced. It is drawn up during labour, and by retroversion of the enlarged uterus, whether this be due to gestation or fibromyoma; or it may be attached to an ovarian or fibroid tumour which has risen into the abdomen. In procidentia uteri, the commonest cause of cystocele, a part of the bladder is displaced downwards, and may lie outside the vagina. In contraction of the sacro-uterine ligaments the bladder is drawn backwards and held partly open, so that it is never completely emptied.

Great protrusions are sometimes met with in the middle line at the scar of a laparotomy wound, or of an abscess. Over-distension of the abdominal walls from any cause, followed by emaciation or the flaccidity of age, is a sequence which lends itself to hernial protrusion of the bladder as of other viscera. The inguinal, femoral, obturator, and ischiatic foramens have all been the site of cystocele, or hernia of the bladder, sometimes accompanied by protrusion of a portion of bowel or omentum. Vaginal cystocele is by no means uncommon in fat and flabby multiparas. The protruding part of the bladder is uncovered by peritoneum except when accompanied or preceded by an ordinary hernia of large size, or when a great portion of the bladder is involved.

Besides the weakened condition of the abdominal walls or vagina, or the easy patency of one of the natural openings in the parietes, two other conditions are requisite for cystocele: these are a dilated bladder, frequent and considerable distension, and frequent straining efforts at micturition. As soon as the bladder has escaped at a hernial protrusion it acquires a more or less sacculated or hour-glass form; and the urine, being constantly retained, at length decomposes, and ulceration, phosphatic calculus, or sloughing may follow.

Cystocele has been mistaken for ordinary hernia, and for abscess. It varies in size with the quantity of urine retained, and may be distended by injecting the bladder with warm boracic fluid. In doubtful cases Agnew recommends puncture and an examination of the fluid withdrawn; but this procedure has its dangers. If a cystocele become strangulated the symptoms may very closely simulate a strangulated hernia; but, in addition, there will almost certainly be other symptoms special to the bladder, such as blood in the urine, painful and frequent micturition, and pain specially referred to the hypogastrium and neck of the bladder. Petit says that in strangulated hernia of the bladder vomiting is always preceded by hiccough, whereas in hernia of the intestine vomiting precedes hiccough.

Treatment.—The pouch of bladder should be kept empty of urine by voluntary micturition or the catheter, and by the application of a truss.

A vaginal cystocele should be treated by an operation for contracting the anterior vaginal wall (*vide* p. 823).

Supernumerary Bladder.—Most of the cases which have been recorded as supernumerary bladders have been either sacculated bladders or bladders bisected by a membranous partition. In some the coats have been complete, and others were probably dilated lower extremities of the ureters. In some of the cases in which the bladder was divided into two, there was an opening of communication between them, in others not; one ureter opens into each division. Fantoni and Mollinetti have described cases of true multiple bladders; that of the latter was a woman who had five bladders, five kidneys, and six ureters. Four of the ureters emptied each into a separate bladder; the other two into the largest bladder.

Absence of Bladder.—Only a few instances of absence of the bladder are on record. When it occurs the ureters open into the urethra, rectum, or vagina; or on the abdomen, generally in the median line. Agnew quotes a few cases in which individuals so affected lived to adult age, suffering little or no inconvenience; others survived but a few days.

Prolapse of the bladder mucous membrane through the urethrovesical orifice is less uncommon in women than in men; it should be treated by applying the actual cautery to the vesical orifice while the wall of the bladder is kept in place by a catheter. Prolapse of the mucous membrane of the lower end of the ureter, and of the adjacent part of the bladder, occasionally occurs through the urethra. Prolapse of the lower end of one or both ureters may give rise to a tumour or tumours within the bladder (29).

Ectopion vesicæ is characterised by a failure in development of the anterior wall of the bladder and of the abdominal wall in front of the bladder; whilst the posterior wall of the bladder projects at the hypogastrium, where it is continuous with the anterior abdominal parietes. This malformation is more frequent in boys than in girls, in the proportion of eight or nine to one. In its causation the theory of arrest of development is generally accepted. The existence of epispadias, the absence or non-union of the symphysis pubis, and other associated malformations of the genital organs, are arguments in favour of this opinion.

Morbid Anatomy.—Ectopion vesicæ appears as a florid red body in the hypogastric, or hypogastric and pubic regions. In very young subjects it is not larger than a nut; in adults it attains the size of an apple. The surface bleeds readily, and is often painful; the lower part is always moister and more vascular than the upper, and upon it there are two small round projections, which represent the orifices of the ureters: on watching these, urine is seen to flow from them—not drop by drop but by a sort of feeble and irregular ejaculation. At the margin the epidermis is continued insensibly into the epithelium of the mucous membrane, and little islands of it are situated on the mucous surface—in fact, there is a tendency for the epithelium to change into epidermis. Around the ectopion the cutaneous surface is marked by irregular cicatrices which are considered to be relics of the allantois. Above the ectopion is a median depression—due to the want of the linea alba—as high as the umbilicus. The umbilicus may indeed blend with the ectopion; if not, it is generally very close to it. The umbilical vein is consequently elongated; the urachus and umbilical arteries are proportionately shortened.[1]

In the female there is a separation of the labia majora, of the two sides of the clitoris, and of the labia minora. The external orifice of the vagina is a mere antero-posterior slit; and in some cases the sex of the infant is doubtful. The vagina and uterus are sometimes bifid. The anus is often placed farther forward than normal. One of the most important features is detected by pressing upon the pubic region, when a wide separation of the pubic bones, varying from 1½ to 6 inches (3 to 12 centimetres), will be recognised. It is quite exceptional for the pubes to be united at the symphysis.

By rectal examination much is learnt; namely, the very forward projection of the sacrum, whereby the antero-posterior diameter of the pelvis is diminished. With the finger in the rectum, and the other hand on the hypogastrium, one feels the posterior surface of the ectopic bladder, and the separation of the pubes is still more distinctly perceived.

Dissection shows the perineal muscles to be ill-developed, and the sphincter vesicæ to be absent—at least, in one instance only does it seem that a sphincter of the urethro-vesical orifice has been found. In place of the symphysis is a fibrous band of varying thickness and resistance. Nothing but a layer of cellular tissue, and not always so much as this, separates the vesical mucous membrane from the peritoneal coat. The condition of the ureters is very important. Following them from the bladder wall, they dip down into the pelvis before turning up towards the kidneys. They are frequently elongated and dilated.

Symptoms.—Individuals with ectopion vesicæ may be otherwise well-formed and robust: most frequently, however, they are thin, weakly, and constantly suffering; as the slightest friction from their linen inflames the vesical mucous membrane. Thus they often die from ascending inflammation ending in suppurative pyelonephritis. As a result of the constant trickling of urine they are always wet and in discomfort, and frequently affected with erythema, excoriations, erysipelas, or more deeply-seated inflammation of the skin and tissues around. Thus they are always in danger of michief ascending to the kidneys. Many malformations of the vagina coexist, especially in connection with the anus. Double inguinal hernia is very common. Sometimes the ileum terminates in the bladder. Prolapse of the rectum or uterus, club-foot, harelip, anencephalus, and spina bifida have also been recorded. Sexual appetite, as a rule, does not exist. In the female conception has occurred, the offspring being naturally formed; but delivery is often difficult, and confinement almost always followed by prolapse of the uterus. Ectopion vesicæ is, happily, very rare. Neudorfer computes its occurrence as twice in 100,000 infants; nine-tenths of the cases of ectopion vesicæ die within a few days of birth. Ectopion is not, however, incompatible with long life, as instances are recorded of individuals so affected attaining the age of 40, 50, and even 70 years.

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[1] The allied condition of epispadias has been described on p. 160.

Treatment.—It must suffice here to name the modes of operation performed:—

(i.) To establish a fistulous communication (*a*) between the ureters and rectum, or some other part of the large bowel; or (*b*) between the bladder and the rectum. The mortality of these two methods has been 40 per cent. (ii.) The autoplastic or flaps method. Mortality, 14·6 per cent. This method has in several cases cured the coexisting inguinal hernias. (iii.) The removal by dissection, or the destruction by escharotics of the mucous membrane of the bladder, except around the orifices of the ureters. Sonneburg, after dissecting off the bladder mucous membrane, sutures the mucous membrane to the base of the epispadias. (iv.) To close the bladder by suturing its two margins. This method is sometimes combined with closure of the interval at the symphysis pubis, after the manner of Trendelenburg.

According to Tuffier the alternatives are as follows:—When the case is one of epispadias, with a small fissure at the symphysial area of the bladder, close the urethra and neck of the bladder by uniting the edges of these parts. So, too, if the defect of the bladder extends somewhat higher, the edges of the bladder should be freshened after dissecting up the mucous membrane without damage to the ureters. If the ectopion is complete and the separation of the pubes considerable, divert the urine into the rectum. In a young and vigorous person employ Dubois' and Dupuytren's method, which consists in suturing together the margins of the bladder. If the genital organs be atrophied, or the patient weakly, or affected by other malformations, suture the mucous membrane to the root of the urethra; or establish a recto-vesical fistula and destroy the mucous membrane of the bladder.

As regards the autoplastic methods, the simple flap is inferior to the methods by several flaps; and the method whereby the flaps are superposed is better than that by which they are simply joined together.

More recently Maydl, with considerable success, in cases of ecstrophy of the bladder, excises the vesical trigone together with both ureteral orifices, and implants them *en masse* into the sigmoid flexure. He then cuts out the remainder of the bladder, and closes up the resulting abdominal aperture. Maydl's operation has been successfully followed by others.

FUNCTIONAL DISTURBANCES OF THE BLADDER. — **1. Functional disturbance due to structural disease of the nervous system.**—(*a*) *Tabes dorsalis.*—(i.) On the motor side there may be paralysis without retention. This paralysis shows itself in a delay, varying from a minute to a quarter of an hour, in starting to micturate; the flow may then stop, to go on again after an interval, and within an instant or two after the act seems to be completed, urine may be passed into the clothes. (ii.) Paralysis culminating in complete or partial retention. (iii.) Intermittent incontinence, which may be due to overflow of urine from the bladder; or it may be caused by a peculiar irritability of the bladder, which leads to a slight discharge of urine directly the patient makes a move to micturate. (iv.) An urgent necessity to pass water, due to tenesmus, accompanied perhaps by cystalgia.

On the sensory side are, in the "excess" direction, urethralgia, cystalgia, vesical colic; in the "insufficiency" direction, anæsthesia of the urethro-vesical mucous membrane, and the loss of muscular sense of these organs. The vesical colic, analogous to the gastric colic, and preceded by crises of variable duration and intensity, is attended by excessive pain. The anæsthesia of the urethro-vesical mucous membrane and of the muscular sense is manifested by the want of consciousness of the passage of urine or of the distension of the bladder. Such patients urinate in a routine manner at stated intervals, not because they have a sense of necessity or any desire to empty the bladder: they must watch in order to know whether they are passing water or not, and when they have finished; some of these patients cannot micturate in the dark.

(*b*) *Pott's disease, and injuries to the brain and spinal cord*, by interfering with the vesico-urethral nerve centres, cause paralysis with retention, and the incontinence of retention or overflow. Disturbances from such causes are very familiar. So, too, are the similar disturbances from serious injuries to the brain.

(*c*) In *general paralysis*, according to Geffrier, there is retention from urethral spasm during the stage of excitement, and retention from paralysis during the period of depression.

(*d*) In certain cases of *insanity* the retention is voluntary, the patients refusing to pass water just as they refuse to take food.

(*e*) In *patchy sclerosis* retention due to spasm of the urethra is caused by the irritation of the lumbar centre for the sphincter of the bladder.

2. Functional disturbances of the bladder connected with epilepsy.—The principal of these is incontinence. It differs from common nocturnal incontinence in its occasional occurrence, and by the patient awaking with a feeling of extreme weakness, exhaustion, and weight in the head, and with the tongue sore or bleeding. Incontinence sometimes occurs during a fit of hysteria.

In hysteria there is occasionally anæsthesia, with spasm of the neck of the bladder; there is great difficulty in beginning to micturate, and this may increase and go on to complete retention. In some hysterical subjects there is involuntary discharge of urine under strong emotion, due to spasm of the detrusor fibres of the bladder. Hysterical retention, due to paralysis of the bladder, is frequent; it is sometimes accompanied by hysterical hemiplegia, or more often by paraplegia. If the paralysis affect both the detrusor and the sphincter vesicæ, these patients get the incontinence of retention.

3. Functional troubles connected with congenital malformations; and, **4. the irritable bladder**, due to morbid conditions of neighbouring organs.

The sensory symptoms are cystalgic pains; the motor symptoms, frequent spasms of the bladder and urethra, which cause frequent, but slow and painful micturition, urgent calls to pass water, and sometimes actual retention. The causes of the symptoms are congenital atresia urethræ, fissure of the anus, hæmorrhoids, operations on the anus, intestinal worms; or uterine, ovarian, vaginal and vulval disorders; or operations on these parts.

5. Functional vesical troubles due to lesions of the urethra or bladder.—The reflex irritation caused by vesical calculus, tumour, or fissure of the urethra in women produces vesical tenesmus analogous to rectal tenesmus from anal fissure. A deep-seated but slight urethritis near the neck of the bladder often causes cystalgia. These causes of painful and irritable bladder must be recognised in order to treat them successfully.

6. Functional vesical troubles caused by the condition of the urine.—The excess of limpid urine in hysterical women, urates in the gouty, and of phosphates in neurotic persons, and any urine which is extremely acid, are well-known causes of irritable bladder.

7. Idiopathic functional disturbances of the bladder, such as cystalgia, and spasms of either the vesical muscle or of the compressor urethræ, sometimes seem to occur independently of any ascertainable cause. True idiopathic cystalgia, Tuffier writes, occurs in persons whose parents are the subject of nervous or rheumatic migraine and who are themselves neurotic. The determining causes are cold, damp, changes of season, constipation, voluntary retention, and irritability of the genital organs.

8. Functional vesical troubles of mental origin.—The enormous influence of the mind over the functions of the bladder are proverbial.

That polyuria, as well as frequency of micturition, may be due to mental influence is proved by the fact that if the mind is engaged and interested both cease as they do during sleep. The patients may pass water fifty times a day, yet sleep all through the night. A greatly increased capacity of bladder is proved to exist in these cases by the capacity for injections of warm water; and yet a catheter left in the bladder as a drain-tube does not remove the desire these patients have to pass water.

Another form of functional disturbance from mental causes is urethral spasm, manifested either during micturition or during the introduction of an instrument. If it occur during micturition we have the condition so happily described by Sir James Paget as "stammering of the bladder," which renders the person incapable of micturating in presence of others, or even in a place where the flow of their urine can be heard. Even when there is no ascertainable lesion about the urinary organs to explain this troublesome condition, there are still many other causes, outside the urinary organs, of incontinence both in children and adults for which search must be made.

Incontinence of urine assumes two very distinct and different forms—(i.) the incontinence of the drop-by-drop kind, the incessant, continuous dribbling; and (ii.) incontinence in the form of intermittent large evacuations of urine.

(*a*) The "continual" incontinence consisting in incessant dribbling of urine is due to paralysis of the vesical and urethral (the membranous urethra) sphincters. It may or may not be associated with retention. If it is, the incontinence is merely the overflow of the bladder and is the "incontinence of retention." If it is "incontinence without retention," the bladder is no longer serving as a reservoir, but has become merely a part of a conduit placed between ureters and urethra. This is a state of absolute incontinence. "Continual" incontinence, if it has not been caused by the effects of over-distension on bladder and sphincter, is probably always hysterical.

(*b*) Some children have nocturnal incontinence whose urinary functions during the day are quite normal in every respect. These are the subjects of incontinence of a psychopathic (mental) origin, and they constitute the majority of cases. It is intermittent incontinence of large quantities of urine; it arises from the child having a besetting dream of passing water, and it is aggravated by the fear that she will wet her bed. This form of incontinence always ceases at puberty if not before, when a different turn is given to the thoughts and dreams of these incontinents.

(*c*) In another class of cases there is incontinence of the intermittent form occurring at night only; but during the day these children have frequent and pressing calls to pass urine, and must give immediate relief to their bladders, otherwise they wet their clothes. This form is due to irritation either of the spinal cord, of the intestines, or of the genito-urinary apparatus. Contracted meatus, oxaluria and lithæmia, and intestinal worms play an important part in it.

(*d*) In another class of cases the children have both diurnal and nocturnal incontinence. They never think for an instant of trying to prevent it. They pass water in the daytime with the same unconsciousness as prevails at night. This form is due either to defective contractile power in the urethral sphincter, or to urethral insensibility. In adults this may occur in consequence of hysteria, of overstretching of the sphincter by too large an instrument or by digital examination. It also occurs as a consequence of spinal lesions, especially tabes dorsalis.

(*e*) During epileptic seizures incontinence takes place at the end of the attack, whether it occur by night or day. It is succeeded by a feeling of extreme prostration and evidence of the tongue or cheek having been bitten.

All forms, except the epileptic, have a tendency to disappear at puberty. After twenty-five years of age they are quite exceptional, if not altogether unknown. Spontaneous cure sometimes unexpectedly follows an attack of fever or some other illness. In some cases, after the incontinence ceases, these persons are obliged to pass water once or twice during the night; and this necessity may continue even throughout life. Many of them, however, get cured of their incontinence, only to become the prey of some other nervous affection such as spasm of the bladder or irritable bladder, or to become confirmed hypochondriacs.

Treatment.—In the psychopathic form moral treatment is the only useful one. The little patient must not be scolded, or punished, or reproached, or made a laughing-stock. She should be encouraged, reassured, and even told not to mind the accident. Let her not go to sleep with a final instruction that she must not wet herself, whereby her last thought is made a connecting-link with her habitual dream. On the contrary, coax her, if possible, into the hope that she is cured; and assure her she ought not to be troubled if she should find she is not. Much is gained if a few nights pass without an accident, and this is sometimes obtained by waking the child just before the hour at which the nurse has ascertained that micturition takes place. Means are sometimes recommended to lighten sleep and increase the irritability of the neck of the bladder. A hard bed, a little tea or coffee taken late before going to bed, are calculated to obtain the one aim, and the passage of catheters or sounds will sometimes accomplish the other.

For incontinence due to irritable bladder the treatment consists in the removal of the cause; thus vermifuge remedies and improvement in dietary to correct oxaluria or lithiasis, are among the means which will be employed.

Incontinence from atony, or from paralysis, will be often rapidly cured by electricity applied to the hypogastrium, or even within the cavity of the bladder.

CYSTITIS.—I. **Acute cystitis** in the female, though less frequent than in the male, is nevertheless far from rare. The absence of the prostate and of the retaining influence of the male urethra, are largely accountable for this. Other causes, such as gonorrhœa, tuberculosis, calculus, and neoplasms are common to both sexes; while the proximity of the uterus and the tendency of the bladder to sympathise with its diseases and displacements add a new set of causes in the female. The physiological solidarity which subsists between these two organs is due not only to the close relationship, but to the remarkably free vascular communications which exist between them. In certain cases, therefore, the bladder is subject not only to compression but to hyperæmia by extension due to this vascular connection. In addition to the fact that the main vesical and the main uterine arteries arise from the hypogastric trunk, there is a free, direct distribution of smaller arterioles from the anterior aspect of the uterus, and the vesical and anterior uterine veins actually unite. Observation shows that there is some increased frequency of micturition, associated in some cases with a slight amount of dysuria, just before and after the occurrence of the catamenia: this is more marked in multiparas and in cases of subinvolution of the uterus.

It is found also that cases of chronic cystitis commonly exhibit exacerbations at these periods (West, Laugier, Bernardet); and a similar increase is noticed with suppression of menses, or at the menopause (Civiale).

During gestation there is an increased vascularity of the neighbouring parts, which is readily observed in the vagina and vulva. Frequent micturition in the early months of pregnancy, before there has been any notable enlargement of the uterus, is so habitual that it is scarcely complained of. More than 50 per cent of pregnant women experience this increase in frequency, as well as pain and occasional slight hæmaturia, but these symptoms are most marked in primiparas.

Cystitis associated with chronic inflammatory conditions of the uterus is most rebellious to treatment, and often disappears only with subsidence of the uterine disease; in cases of urinary trouble, of which the pathology seems obscure, the uterus should always be carefully examined. The mechanical influence of pressure by the uterus or its contents leads both to diminished capacity and to congestion, and these in turn result in greater irritability of the bladder and need for emptying it. The symptoms are most marked when there is forcible and continuous pressure from the head of the fœtus or dystocia, particularly if the pelvis be narrow; in prolonged labour this pressure, though short of producing contusion and sloughing, may lead to cystitis.

Compression differently applied so as to lead to retention of urine is a fruitful source of cystitis. Tumours, displacements of the uterus, or even inflammatory exudations, causing compression between them and the symphysis pubis, interfere with the escape of the urine, produce both congestion and distension of the bladder, and may lead to incontinence, rupture, or grave inflammation. Such cases require gradual evacuation of the bladder and removal of the pressure. It is here, for the most part, that a peculiarly intense form of cystitis occurs characterised by expulsion of membrane in the form of a sac moulded to the internal surface of the bladder.

Cystitis in woman, then, is met with particularly at the menstrual periods; at the menopause; in connection with a congested state of the uterus from pathological causes; in early pregnancy, influenced by the extension of hyperæmia or by retroversion and consequent retention of urine; and towards the end of gestation, owing to malformation or malposition of the fœtus. Post-puerperal cystitis, which is generally the most severe, may be due to direct toxic infection, to fissure of the neck of the bladder, or even to the use of a septic catheter. Apart from pregnancy, cystitis may be set up by cold, excessive coitus, or voluntary over-distension of the bladder.

Etiology.—The causes of acute cystitis are (*a*) remote and (*b*) immediate.

The *remote* are either general or local. Certain constitutional conditions favour the occurrence of the disease: these are commonly stated to be rheumatism, gout, and tubercle. Cold, improper food, and defective hygiene are also regarded among the causes of a remoter kind. The composition of the urine sometimes disposes to cystitis; it is in this manner, no doubt, that gout occasions it. The toxic state of the urine in fever patients, as well as the retention of urine which often affects them, induces congestion of the bladder. Cantharides and some other drugs which are eliminated by the kidneys, by passing over the mucous membrane of the bladder, have a distinct power to cause frequency and pain in micturition.

Immediate Causes.—These are catheterism, gonorrhœa, vaginitis, and other infective processes about the vulva and external urethral orifice. They all produce cystitis by provoking a direct microbic infection of the vesical mucous membrane by means of the secretion and discharges conveyed to the bladder from the urethra.

Pathology.—The first changes in cystitis are a pronounced injection of the blood-vessels of the mucous membrane, especially about the ureteral orifices and the neck of the bladder. As the inflammation advances the mucous membrane swells, takes a bright crimson colour, and the distinct outline of the distended arborescent vessels disappears. Microscopically, the epithelial cells are seen to be swollen, their nuclei broken up, and the rete mucosum infiltrated with leucocytes and embryonic cells. The muscular coat is sometimes similarly infiltrated. Abscesses, ulcers, and gangrene may result.

The bacteriological study of cystitis goes to show that several forms of pyogenic bacteria are capable of exciting cystitis; but the microbe which has been most generally met with is the bacterium coli communis. Others are the uro-bacillus liquefaciens and the ordinary agents of suppuration; and, very much more rarely, the bacillus griseus, the micrococcus albicans amplus, and the diplococcus favus. In men and women it is the colon bacillus which is most frequently found, and which is, indeed, in men the agent of almost all cases of cystitis; but in women the staphylococci, as the elements exciting puerperal cystitis, are met with almost as frequently as the colon bacillus. In cystitis from gonorrhœa, as well as from other causes, the same bacteria are found; it is quite exceptional to meet with gonococci.

Symptoms.—These are frequent micturition—the desire being so imperative that the action of the bladder cannot be controlled, though but a small quantity of urine may be present; considerable smarting followed by some pain after the bladder is emptied; and the presence of pus and sometimes of blood in the urine, often only at the end of micturition. Acute cystitis appears in two very different degrees: one almost insufferable to the patient and alarming to witness, the other much less severe and dangerous. The severity and duration of the symptoms are very variable. Attacks occurring during pregnancy are usually very benign, while those following delivery are even more severe and prolonged than cystitis occurring in man. Apart from pregnancy, inflammation of the bladder undergoes exacerbation at the catamenial periods.

Besides the above functional symptoms there are certain *physical signs* due to the condition of the bladder. These are: (1) Pain and tenderness over the trigone felt on digital examination through the vagina; this pain is much accentuated if at the same time pressure be made over the hypogastrium. (2) Intravesical tenderness. Usually in passing a catheter the discomfort experienced by the pressure of the beak of the instrument along the urethra ceases at once after its entrance into the bladder; but when cystitis exists, pain is aggravated by the presence of the instrument within the neck of the bladder. (3) Distension of the bladder with an antiseptic solution. If this is attempted, even with a very small quantity, intense pain, accompanied with uncontrollable desire to empty the bladder, follows.

As regards the question of temperature, M. Guyon has pointed out that there is no fever in acute cystitis, that the most painful forms of the disease show no elevation of temperature whatever, and that as soon as a febrile temperature appears in a patient with cystitis, it is certain that there is some perivesical, or, much more commonly, some uretero-renal inflammation.

The method of examination in these cases is direct exploration by the finger in the vagina or by the hand on the hypogastrium—or by the two combined. In this way the site and degree of tenderness may be ascertained. In certain acute cases the introduction of the finger into the vagina, or the mere pressure of the hand on the hypogastrium, provokes extreme suffering. In less severe instances the thickness of the inflamed walls may be gauged by the combined method; or this may be arrived at by pressure of the finger forwards against the pubes. The introduction of the sound into the bladder also may demonstrate the exact points and degree of tenderness.

Diagnosis.—The affection as a rule is easily diagnosed by the three classical symptoms: frequency of micturition; painful micturition; and pyuria. The presence of all three of them is necessary. No one of them, taken alone, can establish a right diagnosis.

It is not by the amount or character of the sediment, but by the pain and tenderness on pressure per vaginam, and the fact that the first and last portions of the urine contain most pus, that we diagnose the cystitis to be of the neck and trigone of the bladder. When the whole of the bladder surface is alike involved, the pus is uniformly diffused through all the urine.

The cause of the cystitis ought always to be ascertained, and this can easily be done in the case of calculus or new growth. The chief difficulty consists in distinguishing tuberculous cystitis in its early stage from cystitis due to a chronic urethral discharge. The family history of the patient, the bacteriological tests by means of the microscope or artificial culture, and the presence of tuberculous deposits in other parts, will give the clue to the cause.

Pericystitis will be diagnosed by the high temperature, by the tumefaction felt through vagina or above the symphysis pubis and which is not removed by using the catheter, and by the signs of deep-seated suppuration. It is very rare.

A frequent desire to micturate, apart from any fever or alteration in the character of the urine, may be met with in *cystocele*; but this condition is readily recognised, on examination, by a bulging into the vagina, and by introducing a sound into the pouch.

The presence of pus in the urine, which is one of the prominent features of cystitis, may be due to vaginal discharges; but the other symptoms are absent, and on closer examination the source of the discharge should be discovered.

The differential diagnosis of the various forms of cystitis is a very much more tedious and difficult affair. Of the first importance is a methodical examination of the uterus and its appendages, so frequently does the bladder participate in vascular disturbances of this organ. It is also necessary to search for any evidence of gonorrhœa either in the patient or, if she be married, in her husband. The recognition of pregnancy again, in association with comparatively mild manifestations, is a sufficient indication of the probable cause of the malady. A bacteriological investigation of the purulent deposit in the urine should be undertaken in prolonged or severe cases with a view of discovering the gonococcus or the tubercle bacillus; but the most important means of ascertaining any local condition consists in the bimanual examination of the bladder, and in the introduction of the finger into the bladder through the dilated urethra. This is undoubtedly the best means of discovering any foreign body, new growth, or morbid condition of the bladder wall.

Treatment.—The cause of the cystitis must be removed as soon as possible, and the treatment should be directed towards the uterus where this is also affected. Cases associated with pregnancy are not usually severe, and the termination of gestation may be counted upon to end the cystitis. Baths, narcotics, and balsamic drugs are beneficial; but in really severe cases there is no remedy to be compared with injections of a few drops of silver nitrate (1-500), repeated at such intervals as give the pain of its introduction time to subside. The injection of a solution of sozal or of argyrol is sometimes very beneficial. The most severe cases can only be relieved by dilatation (digital) of the urethra, or even by a vesico-vaginal section (kolpocystotomy) which gives the bladder complete physiological rest.

II. Chronic cystitis.—As a rule cystitis in woman is of the chronic form; though some of the most acute cases I have witnessed have occurred in women after parturition. The cystitis attributed to rheumatism and gout, as well as tuberculous cystitis, is of a slow and persistent kind.

Morbid Anatomy.—The mucous membrane of the bladder is of a slate colour, ecchymosed in places, marbled purplish, blackish, or greenish, and covered with an adherent layer of muco-pus. Sometimes there are large or small ulcers on the surface. The changes in the mucous membrane affect the bladder throughout, but are most marked about the trigone, and least so about the base of the bladder. The mucous membrane is softened, thickened and swollen, and sometimes small abscesses are present both in the membrane and beneath it. The epithelium is exfoliated, the basement membrane infiltrated, and the capillaries hypertrophied. The muscular coats are thickened. The different conditions presented by the mucous membrane have given rise to names as various. Thus are described ulcerative cystitis, gangrenous cystitis, "croupous" cystitis (that is, cystitis attended with the production of false membranes), and the villous form of cystitis (*cystite fungo-vasculaire*). To name these varieties is to indicate the different aspects the mucous membrane may present.

In the croupous cystitis the false membrane is of a yellowish colour; it is composed of fibrinous material, containing in its substance leucocytes and epithelial cells, and it is sometimes encrusted with phosphates. This membrane, which is frequently formed in very acute cystitis and in the cystitis of lying-in women, may invade the ureters and the renal pelves. In other cases the false membrane is made up entirely of epithelium from fifty to one hundred times as thick as the normal vesical epithelium. In gangrenous cystitis the false membrane may be mixed with some of the constituent parts of the bladder membrane more or less destroyed.

Symptoms.—Chronic cystitis may arise insidiously, or may be the sequel of acute cystitis. The symptoms are the same as those of acute cystitis, but in a very much milder degree. The three cardinal symptoms—frequency of micturition, painful micturition, and pyuria—are present together. The degree of pyuria is extremely variable. The pus is always most abundant at the commencement and end of micturition, which indicates that its chief source is the mucous membrane about the neck of the bladder. It also differs much in appearance in different cases, being sometimes yellowish or greenish; sometimes tenacious, glairy, stringy, and adherent to the bottom of the vessel, like a gelatinous coating of greater or less thickness, which cleaves for some seconds to the vessel on pouring off the urine, and then leaves it like a solid or semi-solid mass.

The urine of chronic cystitis is alkaline, and, if not actually ammoniacal, has a strong offensive odour. When the mucous membrane is sloughing, the urine has an odour characteristically offensive.

The physical symptoms of chronic cystitis are very slight; and the general good health is maintained by many patients for a long time, even when the quantity of muco-pus is very large. After a time, however, they become feeble, lose flesh, and look pale and sallow; the skin dries, the tongue is furred, and the digestion becomes difficult or painful. In a large number of cases, chronic pyelo-nephritis is gradually induced; in others, an acute attack of suppuration throughout the higher urinary mucous tract proves fatal.

Diagnosis.—Before making a diagnosis we should inquire as to the three coexisting cardinal symptoms above mentioned. The conditions with which chronic cystitis is most likely to be confused are neuropathic states of the bladder, tuberculosis of the bladder, and pyelo-nephritis. In neuropathic conditions pus is generally absent, though pain and frequency of micturition may be present. The bladder is not oversensitive to the catheter, nor to vesical injections. With even the smallest trace of pus we ought to exclude simple neuralgia. In pyelonephritis there is a uniform turbidity of the urine, and the turbidity remains even after the urine has had time to deposit; the general health is impaired, there are feverish attacks, and, if the bladder is unaffected, the urine is acid. If the bladder be carefully washed out, the urine which flows away through the catheter immediately after is turbid with pus.

Treatment.—The proper treatment of chronic cystitis consists in the daily irrigation of the bladder by suitable antiseptic solutions. This irrigation must be conducted on a careful and systematic plan, not only as regards the details of antiseptic precautions, but in other respects as well. It is harmful to throw in too much fluid at a time, or to inject it with too much force. A tender, inflamed bladder is irritated, not soothed, by such treatment. A soft, flexible catheter of No. 8 or 9 size should always be used if possible; and the solution to be injected should be of the temperature of the body, and not too strongly impregnated with the antiseptic substance. Only two, three, or four ounces should be injected at a time; and then, after being retained for a few seconds in the bladder by keeping the finger-tip on the end of the catheter, it should be allowed to escape. This process should be repeated till the solution returns as clear, or nearly so, as when it was injected.

The best means of injecting the solution is by a 4- or 6-ounce india-rubber bottle, fitted with a graduated nozzle and stop-cock such as are made for this purpose. Or, instead of the india-rubber bottle, a glass irrigator, with a long tube and nozzle at the end, can be hung above the patient's head. This is, perhaps, a more convenient plan when the washing out is done by the patient herself.

Various solutions are employed, thus: acetate of lead (1 or 2 grains to 4 ounces of water); dilute nitric acid (2 or 3 minims to the ounce);

dilute phosphoric acid (3 or 4 minims to the ounce); acetic acid (4 minims to the ounce). These are especially useful where there is a great tendency to phosphatic encrustation of the bladder. Sir Henry Thompson recommended biborate of soda and glycerine; his formula is 2 ounces of glycerine, 1 ounce of biborate of soda, and 2 ounces of water; of this mixture, ½ an ounce is added to 4 ounces of water to form the injection.

Mr. Nunn, as long ago as 1872, used and recommended a solution of quinine sulphate, in the proportion of 2 grains to 3 ounces of water increased to 1 or 2 grains to the ounce. Another drug recommended by Sir Henry Thompson is nitrate of silver of the strength of ½ to 1 grain in 4 ounces, increased to ¾ grain to the ounce. Salicylic acid ($\frac{1}{16}$ per cent) is recommended by Bryan of St. Louis for cleansing the bladder of tenacious muco-pus. Creolin in ½ per cent solution, resorcin, $\frac{2}{15}$ per cent, and a weak solution of boroglyceride are among the numerous substances which may be tried. Instillations, in the form of 20-30 drops of 1 in 50 solution of nitrate of silver, or of sublimate solution (1 in 10,000 increasing to 1 in 5000), are considered by many French surgeons to be the best means of disinfecting the bladder. Much benefit, however, is often derived from an injection of a drachm of iodoform emulsion of the strength of two scruples of iodoform to an ounce of water.

The diet must be carefully regulated; alcohol is to be forbidden.

In women, dilatation of the urethra, vesico-vaginal cystotomy, or hypogastric cystotomy, may have to be performed for drainage. Except in cases where it is reasonable to expect that the drainage will not long be required, the latter operation is to be preferred. In many cases of cystitis, sanmetto in drachm doses three times a day does excellent service. So also does the solution of parsley and kola seed mixed with coco and saw palmetto made by Bell and Company of Oxford Street, and named by them "liquor petroselini cum serenoa compositus." Tyson recommends santal oil to be administered before meals, and an injection of sodium salicylate (a drachm to a pint) or of alum solution to be used.

III. Tuberculous disease of the bladder.—This is a disease which affects persons usually during the period of activity of the sexual organs, but is met with occasionally in children under four years of age, and also in extreme old age. It is three times more common in men than in women. The general causes are the same as of tuberculosis elsewhere. The local are to be found in the frequency of gonorrhœa and other suppurative discharges, and of infective cystitis, which, in persons with this proclivity, are apt to pass into tuberculous disease.

Morbid Anatomy.—The bladder is generally small, shrunken, thickened, and surrounded by a bed of sclerosed fibro-fatty tissues which diminishes the risk of perforation. The mucous membrane is red, irregular, and fungous-looking, especially about the trigone and the orifices of the ureters. Minute grey miliary tubercles are occasionally seen; they may be more or less confluent, but do not form the larger cheesy masses so often met with in the kidneys, prostate, testes, and vesiculæ. Ulceration is present in the more advanced stages: the ulcers have the characters of tuberculous ulcers of other parts; they may be small and numerous, or a large ulcer may have arisen by the coalescence of smaller ones; their depth varies from mere surface destruction to actual perforation. Though perforation is rare, it sometimes results in fistulous openings into the rectum, vagina, or perineum; or, after forming an abscess in the cavity of Retzius, an opening may be established through the hypogastrium. Ulceration may extend through the urethro-vesical orifice and invade the urethra. I have met with deep ashy-grey tuberculous ulcers in the urethra of girls, and also tuberculous abscess at the vesical end of the ureter. It is very rare for the bladder to be the only part of the genito-urinary apparatus affected at the time of death. In cases of pulmonary phthisis the bladder is sometimes found in a very early stage of tuberculosis without any signs of its existence appearing during life.

Symptoms.—The first symptom is frequency of micturition after meals and at night. Then the urine is slightly tinted with blood more or less frequently, and at longer or shorter intervals. Later still, pain occurs and the urine is much thicker and contains pus; then it is that cystitis appears, and, as Tuffier writes, the disease, which till then was "vesical tuberculosis," becomes "tuberculous cystitis." So it may last for years without very greatly affecting the general health.

The functional symptoms are (i.) frequency of micturition; (ii.) hæmaturia; (iii.) pain; (iv.) certain morbid constituents of the urine. Each of these symptoms must receive a brief notice. The frequency of micturition comes on insidiously, and may exist for a long time without attracting much attention. It is due to a slight congestion of the mucous membrane, and increases with its cause, till at length the need to pass water becomes very imperious, and occurs every hour, or even every half-hour; and, in the gravest cases, it may be almost continuous and tantamount to a condition of "false incontinence." It is generally worse at night than in the daytime.

Hæmaturia is an early symptom, but, like the frequency, it may be so slight as to escape the patient's observation for a time. It is compared to the hæmoptysis of pulmonary tuberculosis, and, like the frequency of micturition, is due at first to active congestion of the mucous membrane; later, however, there may be an actual hæmorrhage from the ulcerated surface. As an early symptom, it is spontaneous and slight, the urine being faintly pink or rose-tinted throughout; but a few drops of pure blood may issue at the end of micturition. As it comes, so it goes, without obvious cause; it is thus unlike the hæmaturia of calculus, but like the hæmaturia of tumour. In one respect, however, it differs from the bleeding of tumours, which is free and abundant, whereas the hæmaturia of tuberculosis is slight. In the middle stages of the disease the hæmaturia may cease; but in the later, if it should recur, it may be very considerable.

Pain is an indication of cystitis. It is often brought on by sounding, after which the three cardinal symptoms of cystitis may appear; namely, frequency of micturition, pain, and pus. In some cases the pain of tuberculous cystitis is by no means severe, and certainly not incompatible with the ordinary pursuits of life. In others it is frequent and intense, or even continuous and agonising; it precedes, accompanies, and follows micturition; and as the frequency of micturition is increased by the cystitis, there may be no cessation day or night of the terrible sufferings.

Sometimes the pains are accompanied by spasm of the membranous urethra, and thus temporary retention adds greatly to the distress. In the most advanced stage, especially if the neck of the bladder have been partially destroyed by ulceration, there may be incontinence of urine. Polypoid excrescences sometimes occur about the urinary meatus and urethra of women affected by tuberculous disease of the bladder.

The Urine.—With the onset of the frequency of micturition there is increase in quantity to three or four pints, but the urine remains clear; later it may become purulent with the cystitis. Tubercle bacilli are found in the first stage, but not when there is much pus. It should be borne in mind, however, that the bacillus of tubercle is sometimes simply eliminated with the urine, though no part of the urinary or urino-genital tract is the seat of tuberculous disease.

Diagnosis.—Vesical tuberculosis ought to be suspected in any case in which frequency of micturition, with slight hæmaturia, occurs between the ages of fourteen and forty-five; especially if the patient have a tuberculous aspect or family history. If cystitis occur, and the presence of tubercle be ascertained in the lungs, generative organs, or other parts, the diagnosis becomes pretty certain. Some nervous diseases may simulate tuberculosis of the bladder; but there will be other evidence of these, and the pains will precede the evidence of cystitis.

Vesical calculus presents a different form of hæmorrhage; and the symptoms are allayed by rest in the horizontal position. Vesical tumours cause more copious hæmorrhage, and less marked frequency of micturition. From cystitis due to other causes, tuberculous cystitis is distinguished by the onset and course of the disease, and by the result of examination of the urine. There may be some difficulty in making a diagnosis in those cases in which the tuberculosis has followed an old gonorrhœa or a deep-seated urethral discharge.

From tuberculosis of the kidneys and ureters the diagnosis is often very difficult. The disease in the bladder progresses very much more slowly than in the kidneys. In tuberculosis of the bladder the urine is at first, and for a long while, much less charged with pus, and that which is first passed contains more than the rest of the urine; and there are not the digestive disturbances, the dry tongue, and the rapid emaciation which are produced by renal tuberculosis.

In women the diagnosis is more difficult than in men. Hæmaturia, rather than frequency of micturition, is likely to be the first symptom noticed; the sexual organs do not give corroborative evidence, and cystitis is more often met with in women without obvious cause. Inoculation experiments and the inefficacy of general treatment will indicate the diagnosis. In doubtful cases of urinary tuberculosis, the thermometer seldom fails to assist us, as the temperature nearly always rises. The injection of tuberculin has been sometimes employed, but its use should be restricted; very little importance can be attached to its reaction as a means of diagnosis in man.

Prognosis.—The course of tuberculosis of the bladder is a slow one; acute attacks are frequently followed by periods of amelioration, and the disease may last some years. If the tuberculous process itself does not reach the kidneys, the end is generally brought about by pyelo-nephritis of the common suppurative form. Occasionally tuberculous peritonitis, acute phthisis pulmonalis, or acute general tuberculosis, is the immediate cause of death. Chronic abscesses about the bladder, and the continued discharges from the resulting fistulæ, help to wear out the patient.

Treatment.—Surgical treatment based on the radical extermination of the microbic cause of the disease has up to the present been disappointing.

The general and medicinal treatment in the early stages of the disease—as regards climate, diet, clothing, medicines, dry frictions, sulphur or salt baths, sea voyages, visits to the thermal springs, arsenical preparations, creasote, cod-liver oil—are the same as in pulmonary phthisis. Articles ought especially to be avoided which, through the urine, irritate the bladder; such are all kinds of alcoholic stimulants, curries, spices, nux vomica, juniper, and so forth. It is to medicinal, rather than to surgical means, that the patient should look for benefit.

Mercurial "instillations" sometimes render great service. These instillations consist of the injection into the bladder of from 10 to 40 drops of sublimate solution, varying in strength from 1 in 5000 to 1 in 1000. It is claimed for this treatment that it acts not only as a medicinal remedy to relieve pain, but as a germicide to kill the microbes; and that its value is perceived in early stages by its success in relieving frequency of micturition. Injections of solutions of sozal, of argyrol, and of argonin are worthy of trial, as they sometimes are followed by good results.

If these means fail, and the bladder becomes very irritable and the pains severe, morphia must be liberally administered; even if required to the extent of several grains in the twenty-four hours. Of course the dose at first must be small, and the increase must be cautious and gradual; but very large doses will ultimately be tolerated.

Cystotomy should be the last resource, and only employed to relieve frequent and severe pain and irritability of bladder. Suprapubic cystotomy followed immediately by curetting and the application of nitrate of silver, or chloride of zinc, or sublimate solution (1 in 5000) to the seat of the disease has afforded great relief, and in some cases seems even to have cured the disease. The prolonged drainage of the bladder after suprapubic cystotomy is probably an important factor in bringing about the improvement. Treatment by tuberculin (T. R.) has recently appeared to give some promise of success.

INJURIES TO THE BLADDER.—**Rupture.**—Ruptures of the bladder are of three kinds: traumatic, idiopathic, and pathological.

Etiology.—The traumatic are caused either by violence from without, or by violent muscular efforts on the part of the patient herself; the pathological result from ulceration, sloughing, thinning, and sacculation of the parietes; the idiopathic result from the spontaneous yielding of the distended bladder, independently of any form of violence, or of previous ulceration, sloughing, or tunicary herniæ.

In rupture during labour the distended bladder is compressed between two strong muscular forces; namely, the contracting abdominal parietes and the contracting and enlarged uterus. In rupture during the struggles under anæsthesia, and during powerful muscular efforts, such as lifting or pushing, the bladder-wall is passive and the rupturing force is in the abdominal parietes. Traumatic ruptures form the bulk of the intra-peritoneal cases and of those which are partly intra-peritoneal and partly extra-peritoneal.

True idiopathic ruptures, or those which occur when there is no disease, and where no violence was used, are very rare. In most cases of rupture during urinary retention the bladder gives way under forcible muscular efforts as explained above. Thus this class is restricted to certain cases of rupture from simple over-distension due to tumours, retroversion of the gravid uterus, and the like; to cases of spontaneous rupture during alcoholism, erysipelas, fever, hysteria, and other serious illnesses; and finally to its occurrence in the fœtus in utero.

In pathological rupture the bladder, weakened at certain spots by ulceration or tunicary hernia, gives way under distension; or it sloughs as the result of pressure or inflammation.

Rivington collected 9 cases of intra-peritoneal rupture from retroversion of the gravid uterus; 2 of intra-peritoneal rupture from extra-uterine fœtation; and 7 cases (3 intra-peritoneal, 3 extra-peritoneal, and 1 doubtful) due to ulceration. Krukenberg, who has collected 10 cases of rupture from retroversion of the gravid womb, and added 1 observed by himself, considers the pathology of rupture of the bladder and gangrene of the vesical wall to be identical. In some cases protective adhesions on the peritoneal surface are formed during the progress of the gangrenous inflammation of the coats of the bladder, and then the gangrenous parts may be cast off entire or broken up; otherwise, perforation attends the separation of the slough, even without over-distension of the bladder. Rupture may also take place suddenly from over-distension before the separation of any slough; or may result from efforts, even the most gentle and careful, to replace the uterus. Krukenberg adds that when retention of urine persists for ten days or longer, either gangrene or rupture of the bladder may occur; but rupture more frequently. He also gives the warning that, if gangrenous portions of the vesical wall have been cast off, no attempt should be made to replace the uterus; but that abortion ought to be induced. The pressure of a retroverted gravid uterus has caused gangrene of the walls of the bladder in several instances.

The Situation of the Rent.—The posterior surface of the bladder is the common site, and the more or less vertical line the common direction of the simple intraperitoneal traumatic rupture. This rule, however, is subject to many exceptions. In spontaneous ruptures the rent is commonly behind, and is usually small and round.

The quantity of urine effused into the peritoneal cavity varies, and increases as life is prolonged. If death occur within three days a large quantity may be present without any signs of peritonitis. Surgical casualties in operations on the abdomen have repeatedly shown that healthy urine is harmless to the peritoneum, especially if it can find an exit; and, moreover, that it may be rapidly absorbed. Experiments, too, show that a small quantity of urine injected into the peritoneum is inoffensive; that injections may be repeated with impunity; but that a persistent effusion excites peritonitis (Tuffier). On the other hand, when life has been prolonged, and septic elements have been introduced by the catheter, or have established themselves about the inflamed and contused edges of the wound, the evidences of peritonitis will be well marked.

Diagnosis.—The most certain evidence of intra-peritoneal rupture is the entrance of a catheter into the peritoneal cavity through the rent in the empty bladder. In extra-peritoneal rupture signs of urinary extravasation may appear soon; but in some cases they are not apparent for many hours. The injection of a warm antiseptic solution into the bladder may be of great use in diagnosis; if the bladder is sound, the usual swelling of a distended bladder will be formed, and will disappear on the return of the fluid through the catheter.

Prognosis.—This is most grave. Recovery after intra-peritoneal rupture has, however, been known to follow simple drainage of the bladder by catheter: this was the result in two cases under my own care. Walsham has collected 28 cases of intra-peritoneal rupture of the bladder treated by sutures since 1888; of this number 11 recovered and 17 died. In only 1 out of the 11 successful cases was peritonitis present at the time of the operation; whereas in 8, and probably in 9, out of the 17 unsuccessful cases peritonitis had set in before the operation was commenced. The causes of death in the 8 cases in which peritonitis did not precede the operation were shock or hæmorrhage, or both combined in 5; peritonitis from leakage in 2, if not in 3. In 4 out of 17 cases the rent had not been securely closed and leakage occurred.

Treatment.—The first thing in many cases will be to attend to the condition of extreme shock by the application of warmth, gentle stimulation, and the like, requisite in all such cases. Next must be the prompt local treatment to prevent the further escape of urine into the peritoneum or pelvic cellular tissue by providing a ready exit for the urine as it reaches the bladder by catheter; and by closing the wound in the bladder by sutures when this is possible. And here everything depends upon an early and an accurate diagnosis. If the case be one of intra-peritoneal rupture no time is to be lost (where sufficient assistance and proper convenience can be obtained for the operation) in performing laparotomy, clearing out the urine and blood from the peritoneal cavity, and securely suturing the opening in the bladder-wall.

When the surgeon is single-handed, and cannot get assistants or appliances within twenty-four hours, let him employ antiseptic catheter drainage of the bladder from the outset, and reduce to a small limit the quantity of fluid drunk by the patient for the first three or four days. Paracentesis of the abdomen or recto-vesical pouch need hardly, if ever, be performed.

In extra-peritoneal ruptures a catheter should be retained in the bladder, with the most rigid antiseptic precautions, taking care that the instrument is large, and that the urine is run off into a vessel, containing an antiseptic solution, placed beneath the bed.

Vesico-vaginal fistula.—A communication between the bladder and either the uterus or vagina, so as to admit of the more or less continuous escape of urine, is a condition productive of extreme distress. The size of the opening varies from that of a pin's point to a diameter of an inch or more. When recent the aperture is usually at its largest, diminishing later by cicatricial contraction. At the same time the bladder shrinks, and the walls are contracted and thickened. Sometimes the mucous membrane of the bladder can be seen to protrude through the opening in the vesico-vaginal septum. The urethra is often considerably narrowed, as a result of disuse, and the edges of the fistula are thickened and sometimes held apart by cicatricial fibrous tissue.

Etiology.—By far the commonest cause of communication between bladder and vagina is cancer of the cervix uteri extending to the septum and causing its destruction. When the disease has reached this stage it is beyond the power of remedies; it only remains to adopt measures for soaking up the escaping urine and protecting the skin. Fistula developing in connection with parturition belongs to a different category. It results either from direct laceration or, more often, from sloughing, following continued pressure of the fœtus within the pelvis. Other less frequent causes are necrosis attending diphtheritic inflammation of the bladder, and ulceration produced by the long-continued pressure of a pessary in the vagina.

Symptoms.—These are chiefly due to the escape of urine by the vagina and the consequent irritation of the skin. Besides these, however, amenorrhœa, sterility, and constipation are usually present, with great impairment of the general health.

The *diagnosis* is generally easy. Where the apertures are small or concealed the bladder should be distended with milk or some coloured fluid, while the vagina is carefully inspected by means of a speculum.

Treatment consists in pairing and suturing the edges, after fully exposing the site of the lesion, and in draining the bladder till they have united. [*Vide* article on "Plastic Operations," p. 811.]

Foreign Bodies.—Foreign bodies gain access to the cavity of the bladder (i.) through the urethra; (ii.) when forced through its walls by injury; (iii.) by means of ulceration, or the formation of a fistula, which is most often of cancerous origin.

In the first category, by far the greater number are substances introduced by patients either aimlessly or to allay itching or for some sensual purpose; the variety of things which have been so introduced is almost endless. In the second are found bullets, pieces of bone or of raiment, or buttons. Foreign bodies which ulcerate into the bladder, or find their way along fistulous tracts, come either from the vagina, the rectum, or the higher intestines, from extra-uterine gestation cysts, from dermoid cysts, or from abscesses in the pelvic cellular tissue.

In this way vaginal pessaries have passed through the vesico-vaginal septum; pieces of horn, coins, fæcal matter, and intestinal worms have entered from the bowel; fragments of a fœtus in extra-uterine gestation; hair and teeth from dermoid cysts; hydatids; and pus and bone from pelvic abscesses.

From the observations of Guyon and Henriet it appears that, when once fairly within the cavity of the bladder, foreign bodies occupy most frequently a transverse position between the summit and the neck of the bladder, and rather nearer the neck. In the empty bladder this position is more constant than in the full bladder; in the empty bladder it is the only position which bodies not longer than ten centimetres can take. Smaller bodies can occupy any position in the distended bladder; but in the empty, or nearly empty organ, they assume the line of the transverse diameter. A body of twelve centimetres in length takes a vertical position, or, if one of its ends is buttressed near the neck, it may lie obliquely. Light bodies float; hollow ones, such as a piece of tubing or of a catheter, generally lie in the base of the bladder. Some become disintegrated and are passed in particles, perhaps even without the patient's knowledge.

Foreign bodies, when in the bladder, may remain entirely quiescent, or they may excite cystitis; after a time they may cause ulceration and perforation, and, giving rise to a perivesical abscess, may escape by the direction through which the abscess is either opened or spontaneously discharged. Or the foreign body, having penetrated the vesical wall, may remain partly within the bladder and partly within the peritoneal cavity. The foreign bodies become encrusted with phosphates, and then form the nucleus of a stone. This deposition begins, in some instances even within twenty-four hours, upon the largest part of the foreign body and proceeds towards the extremities; these parts, however, never become encrusted.

Symptoms may be entirely absent; but, as in the case of calculus, the rule is for the patient to have pain and frequent micturition, and possibly to discharge a little blood at the end of micturition. Hair and other rough or sharp bodies are apt to excite cystitis with its attendant cardinal symptoms. If the foreign body penetrate the cellular tissue and form an abscess in the pelvis, the local and constitutional signs of inflammation and suppuration ensue. If they penetrate into the rectum there will probably be rectal tenesmus; if into the peritoneum or small intestines, signs of peritonitis will most likely occur.

Diagnosis.—When the foreign body has been introduced by the patient the readiest road to a correct knowledge of the case is the frank admission of the patient; but she often denies any knowledge of what she herself has done. In surgical accidents, such as catheters breaking off in the bladder, there is no room for doubt. In traumatic cases there is the history of the injury and the presence of a wound or scar. In perforation of the vaginal septum there is the history of local pain, and probably the existence of the ulcerated aperture or its scar. When the foreign body has passed through from the intestinal tract there may be, or may have been, the escape of gas, fæces, or ingesta along the urethra. In the case of hysterical women, however, it is necessary to bear in mind that all sorts of things are designedly mixed with the urine after it has been voided. Hydatids passed with the urine will give the clue to their presence in the bladder.

It is of great importance, especially with a view to its extraction, to learn, if possible, the shape and size of the foreign body, and the length of time it has been lodged in the organ. In all cases of doubt the surgeon should examine the bladder (*a*) by the finger in the rectum, in the vagina, or passed into the bladder through the dilated urethra, (*b*) by sounding, (*c*) by the cystoscope, and (*d*) by X-rays.

Treatment.—If the foreign body has been recently introduced, and it is soft and pliable, like a piece of tube or gum-elastic catheter, it can readily be extracted by the lithotrite, no matter how it is seized by the blades of the instrument. Hard, rounded bodies can also be easily extracted by the lithotrite; either with or without breaking them into fragments. Elongated substances, whether blunt or sharp, give great trouble because of the difficulty of catching them in their long axis. Vesical palpation or vesical inspection (see p. 672) will afford assistance in this respect by informing us of the direction in which the body lies. Some bodies, such, for example, as a hairpin, may be luckily caught at their curved ends and withdrawn by means of a blunt hook at the end of a flexible stem.

When the foreign body has become encrusted with calculous matter, some advise that the deposit should be detached by the lithotrite, and the foreign body extracted in the same manner as if it had only recently been introduced; and that the calculous matter should then be removed as in litholapaxy. This, however, is by no means always easy; and sometimes it is quite impossible to detach the calculous matter thoroughly from the foreign body: on the whole, it is the better practice in most cases of calculous formation to remove the foreign body by suprapubic operation, without attempting the double procedure with the lithotrite and extraction instrument.

Bodies such as twigs of trees are very dangerous, as they are liable to be broken, and their leaves or broken particles may cling to, or stick into the mucous membrane, whence they cannot be dislodged either by instruments or irrigation. Cystitis is very apt to arise, and to be followed by ascending suppuration and death from pyelo-nephritis. This complication, of course, may occur in the case of other foreign bodies.

In women it will be rarely necessary to resort to any cutting operation, as the dilatability of the female urethra allows the extraction of most foreign bodies which can enter the bladder.

After extraction the treatment is the same as after extracting an ordinary calculus, and will vary according to the presence or absence of cystitis.

NEOPLASMS.—New growths of the bladder present numerous histological varieties and considerable clinical differences. Clinically, some are benign and others malignant; histologically, the benign comprise papilloma, myxoma, fibroma, and myoma. The malignant are carcinoma and sarcoma. The following table shows the relative frequency of malignant and non-malignant new growths in the bladder:—

	Total.	Males.	Females.
Cancer	59	43	16
Sarcoma	6	5	1
Fibroma	2	1	1
Papilloma (villous)	23	21	2
	90	70	20

There are some characters common to all bladder tumours. Their usual situation is about the trigone and the orifice of the uterus. Benign tumours are generally rounded, often polypoid or tufted; the malignant tumours are more diffuse. Their size varies from that of a cherry to that of an egg; larger growths are rare, and are generally myoma. Cancerous and sarcomatous tumours are not unfrequently multiple, the masses being apparently independent of one another. Tumours may be embedded in the vesical wall, or sessile, or pedunculated on its surface; or they may infiltrate it.

Papilloma is of two kinds: the fimbriated or "villous polypi," and the fibro-papillomas or "papillary tumours." In the villous polypi the stalk sends off numerous branches and sub-branches of polypi, which consist of a capillary vessel covered by a basement membrane and a more or less thick layer of epithelium; in the papillary tumours the stroma is compact and has a dense fibrous or muscular structure, amongst which may be found embryonic cells and leucocytes. The villous polypi are very frequently multiple, and form tufts or feathery bunches of varying lengths more or less spread over the mucous surface; these float in the urine. When very long their extremities are often carried into the urethro-vesical orifice during micturition and are there nipped by the sphincter; this is a cause of considerable suffering. There is no infiltration of the vesical wall about their points of attachment. The papillary tumour or "fibro-papilloma" may be single or multiple; it is generally rounded in shape, and of the size of a pea, a cherry, or a walnut. It is more often sessile than pedunculated; its surface is villous, but its consistence is firm.

Myxoma is in reality a "fibro-papilloma," or a fibroma, the cell portions of which have undergone a mucoid degeneration. These tumours are soft in texture, grow rapidly, and are met with most frequently in young children. They are probably often congenital, frequently multiple and pedunculated; their common situation is near the neck of the bladder, and they may extend into the urethra.

Fibroma originates in the deep mucosa or in the muscular layer, and is covered by normal epithelium. Like myxoma, these growths are pedunculated; but they occur in adults, and have not yet been found in children. They are very rare.

Myomas are rare; two cases reported by Belfield show indisputably that they may arise from the vesical wall. They occur as nodules encapsuled in the submucosa; they may be composed either of unstriped muscular fibres (myoma), or of this mixed with fibrous tissue.

Sarcoma is comparatively rare, but its rarity has probably been greatly exaggerated.

Carcinoma.—Two varieties are met with: (i.) epithelioma, that is, squamous-celled carcinoma, or cylindroma; and (ii.) glandular-celled carcinoma, either encephaloid or scirrhous. Colloid degeneration of the glandular-celled carcinoma may occur, but is rare. Secondary carcinoma is more frequent than primary, and may be consecutive to cancer of the rectum, vagina, or uterus. These tumours form prominent, irregularly-rounded swellings, widely attached, and infiltrating the vesical coats more or less deeply. Their surface is granular, and in the later stages is ulcerated; occasionally they present gaping ulcers with raised and indurated walls. They are hard, but friable; and therein differ from the softer but little friable fibro-papillomas. They are often multiple, and are most common in the trigone or base of the bladder. They develop slowly, seldom ulcerate early, and cause death before they attain any great size, and often before the appearance of secondary growths in distant organs.

Some tumours which have been exceptionally found in the bladder are adenoma, angeioma, serous cystoma, and dermoid cystoma. The latter is probably due either to an abnormal development of the bladder-wall, by which a portion of the epiblast fills in a deficiency, or is perivesical in origin.

Mucous polypi, having a texture resembling that of ordinary nasal polypus, except that the epithelial covering is squamous instead of ciliated, have been found in the bladders of children under two years of age, as well as in adults. In the early stage they may not give rise to any symptoms; later they may simulate vesical calculus, and growing to a considerable size project even beyond the urethra, or distend the bladder to the level of the umbilicus.

Bilharzia hæmatobia sometimes causes masses of fungating exudation of considerable size in the bladder. It is not an uncommon cause of hæmaturia in the Nile district [Art. "Bilharziosis" in *Syst. of Med.* vol. ii. part ii. Tropical Diseases].

Pathological complications of bladder tumours are :—(i.) local thickening of the bladder walls due to hypertrophy of muscular and interstitial tissue ; (ii.) hydronephrosis ; (iii.) calcareous deposit on the surface of the tumour ; (iv.) occasionally a phosphatic calculus free in the bladder, the result of a cystitis provoked by the growth, possibly a portion of the growth broken away from the rest may form its nucleus ; (v.) suppurative pyelo-nephritis with or without distension of the kidney.

Symptoms.—Bladder tumours are met with at all ages : the sarcomas and myxomas in children, cancer between forty and sixty. They are much more common in men than in women.

A small number of tumours of the bladder, quite unsuspected during life, have been found in autopsies. But as a rule their presence is made only too apparent by hæmorrhage, pain, frequency of micturition, and, not unfrequently, by the presence of a swelling felt either through the vagina or through the anterior abdominal wall. Hæmaturia is by far the most constant symptom ; in some cases it is the only one, and sometimes is alone the cause of death. It is nearly always the first symptom complained of, and the one which brings the patient to his doctor. Its onset, its course, and its abundance are characteristic of tumour. It comes on spontaneously without injury, fatigue, or even movement ; and it causes no difficulty in micturition unless a clot for a while obstruct the urethra. It may be excited by catheterism or by distension of the bladder ; and rest even in the recumbent position has no effect in stopping it. After the hæmaturia has existed for hours, days, or weeks, the urine may suddenly become quite clear. Whilst the hæmaturia lasts, the urine is not equally charged with blood at each micturition ; more blood is passed at the end of micturition than at any other period of its flow ; the quantity is often exceedingly great, and the loss, even from a small innocent growth, may be fatal. In cases of repeated or prolonged hæmorrhage the patient becomes anæmic and waxen-looking, and the lower extremities œdematous.

Pain is not a constant symptom ; it appears late, and is generally due to cystitis. When it exists it is often very intense, and is worse at the end of micturition. It is felt in the hypogastrium and at the neck of the bladder, and radiates down the thighs. But, except from cystitis, from nipping of the growth by the sphincter vesicæ, or from retention due to clots of blood, pain occurs only when the growth is pressing upon the nerves as it infiltrates the bladder-wall.

Physical signs are those ascertained by abdominal or vaginal examination, by vesical palpation and inspection (see p. 672), by injecting fluid into the bladder to the degree of distension, and by the catheter. With the patient lying on her back, with her knees and shoulders raised, we can, in a thin person, sometimes feel the tumour through the abdominal walls immediately above the pubes. Still more frequently it can be felt by vaginal examination, especially if at the same time the bladder be firmly pressed upon by the left hand applied on the hypogastrium. The result of this kind of examination may be positive or negative. It may be negative if the growth be either villous polypus or fibro-papilloma, or a small pedunculated myxoma-fibroma; but if we feel an irregular nodular or infiltrated vesical wall or thickened mass above the neck of the bladder, we know the disease is malignant. Mucous polypi, when large and abundant, have also been felt by bimanual pressure, one hand being firmly dipped down behind the pubes, and one or two fingers of the other hand within the vagina, pressing upwards and forwards the base of the bladder. The feeling of a soft, sponge-like substance between the bladder-walls is thus given by a villous papilloma.

It is well always to examine the urine first passed after this kind of examination; for when tumour is present the examination is often followed by slight hæmorrhage. The catheter and sound ought to be used with the greatest care, not only as to their aseptic condition, but with deftness so as to avoid bruising the tissue of the tumour and provoking hæmorrhage.

Diagnosis.—This can generally be made pretty accurately (1) by the character of the hæmorrhage; (2) by the physical signs described above; (3) by the cystoscope or tube, which in certain cases enables the new growth to be actually inspected; (4) in woman, by digital examination per urethram, which affords absolute certainty as to the presence or absence of growths, even the smallest; and this should be preferred to all other methods.

If a tumour of some weight or volume be detected, or a general thickening or infiltration of the base of the bladder exist, we conclude that the growth is malignant, and the prognosis very serious. The distension of the bladder with a solution of boric acid or weak carbolic solution, if it excite hæmorrhage as the last drops flow away, is a valuable diagnostic guide to the vesical origin of hæmaturia. Sometimes, especially if the growth be near the neck of the bladder, a drop or two of blood flows through the injection catheter, either as it enters the vesical cavity or as soon as the injecting process ceases. The cystoscope in some cases gives most valuable information; but it is useless in cases in which there is blood in the bladder, and it ought not to be used upon all patients indiscriminately.

The chief difficulty in most cases is to determine whether the hæmaturia be of renal or vesical origin. This may be decided by the presence of local signs in the renal or vesical regions, by the presence of renal or ureteral casts, and by a consideration of the several symptoms. The difficulty is accentuated when both regions, or neither, yield positive evidence. We must then have recourse to illumination or digital exploration of the bladder (see pp. 672, 673), or to distension of the bladder with antiseptic solution, or to sounding. When a tumour is present these last-named measures are apt to excite hæmorrhage.

From the hæmorrhage attending acute and chronic cystitis, tuberculous disease of the bladder, and calculus, the diagnosis will be readily made by a careful attention to the history of the case, and to the cardinal symptoms of the respective diseases. There are cases of hæmaturia in which it is impossible to be sure of the source of the bleeding; in some it is due to congestion and varicosity of the vessels of the bladder.

Prognosis.—This is always serious. The malignant growths are unfavourable for removal, as they infiltrate the vesical walls and quickly recur. The benign tumours are often easily removable; but some, especially the villous polypi, are prone to come again. I have removed such growths by supra-pubic cystotomy on five occasions over a period of nine years, from the same men. Then there is the danger from hæmorrhage, which may be fatal; from cystitis running on to pyelo-nephritis, or from intermittent hydronephrosis. These causes of death arise from innocent as well as from malignant growths.

As to the duration of life, Féré gives for malignant tumours eighteen months to two years, Barling three years; whereas Guyon has operated upon patients for epithelioma in cases in which the first symptoms of bladder tumour dated back ten years previously. Such cases indicate that cancer progresses much more slowly in the bladder than elsewhere; but it should be remembered that tumours which are benign at first can subsequently become malignant. We know this to be the case also in uterine myoma, and in tumours of other kinds in other parts of the body.

Vesical malignant growths infect other parts or organs but slowly; death is by no means invariably due to secondary invasions. The benign growths may go on for years, causing only occasional hæmorrhage at longer or shorter intervals, and of greater or less severity. I have known cases go on for ten years or more; and when at last an operation has become absolutely necessary, a mass of villous polypi enough to fill a breakfast cup has been removed.

Tumours of the bladder, if left alone, almost always cause death; though their progress, especially in the benign cases, may be very slow. It is mostly by hæmorrhage that the fatal result is brought about; in other cases by pyelo-nephritis, the sequel of cystitis.

Treatment.—The best palliative means in malignant new growths are incision and drainage of the bladder; the only curative means is, of course, excision of the tumour.

In woman the best incision for palliative purposes is through the vesico-vaginal septum; sutures should unite the vesical with the vaginal mucous membrane over the edges of the incision, so as to secure a permanent opening. When the bladder-wall is not largely involved, if the growth is situated at or near the fundus, and if the condition of the kidneys does not forbid, the curative treatment should be carried out; if, however, after opening the bladder, the disease is found to be too extensive for removal, or situated around the ureteral orifices, the surgeon must fall back upon palliative means.

When an infiltrating growth is felt, per vaginam or with the sound, to involve a large surface of the bladder-wall, especially in the neighbourhood of the ureters and neck of the bladder, no operation whatever should be proposed unless the hæmorrhage be copious or the symptoms of cystitis severe; then an incision, for palliative purposes only, should be made. This should be when possible the vesico-vaginal boutonnière. By these means we place the bladder at rest; we thus remove the septic urine from an inflamed bladder by drainage; and we check the hæmaturia by preventing the alternation of distension and contraction of the bladder which is the chief cause of the bleeding. When the disorganised state of the kidneys is unfavourable to any prolonged operation, the vaginal drainage is still indicated to check hæmorrhage, or for the relief of the sufferings caused by cystitis.

Urethral dilatation enables many non-malignant tumours to be removed easily and thoroughly through the canal; and as the urethra can be dilated to between two and three centimetres without fear of after ill-consequences, this route is the most satisfactory for the majority of cases suitable for curative treatment. Where the growth is too large to be removed through the female urethra, hypogastric cystotomy should be performed. It must suffice here to say that the methods for removing the growths are by—(*a*) tearing them away, (*b*) crushing them off with forceps or écraseur, (*c*) curetting, (*d*) cauterisation, (*e*) excision with the bistoury and closing the wound in the mucous membrane by sutures, or searing the surface with the cautery, (*f*) torsion.

Tuffier records 43 operations through the urethra without a death, and 5 suprapubic operations all successful.

STONE IN THE BLADDER.—Vesical calculus is rare in women, because, owing to the shortness and dilatability of their urethra, calculi which can traverse the ureter can easily escape from the bladder. Moreover, gravel and gout are much less frequent in women than men. Local causes of the formation of stone in the bladder are all those which tend to the stagnation of urine in the bladder and to the development of cystitis. When these two conditions, decomposition of urine and cystitis, occur together, as so often they do, the ammonia-magnesian phosphates are precipitated. This precipitation may occur spontaneously, and thus lead to the formation of a primarily vesical calculus; or it may take place even more readily around a concretion which has descended from the kidney; and this is the process by which uric-acid calculi become enveloped in a white casing of the phosphates.

It is by this same precipitation of the phosphates that foreign bodies in the bladder become encrusted with salts, and calculi are formed with such things as blood-clots, pieces of bone, hairpins, twigs of trees, berries, and so forth as their nuclei. In the same way, too, the surface of vesical tumours and the ends of catheters retained in the bladder become encrusted with a more or less thick white layer.

Chemical Composition.—There are three chief classes of vesical calculi: (i.) The most frequent are formed of uric acid and its combinations; (ii.) the next in frequency, of phosphoric acid in combination with volatile alkali and the alkaline earths; and (iii.) those of oxalate of lime.

The symptoms are pain, frequency of micturition, and hæmorrhage. To these may be added—(*a*) the sudden interruption of the stream of urine, a symptom to which, however, undue importance is often given; (*b*) the patient's clinical history, especially as to the passage of gravel or sand; and (*c*) the previous occurrence of an attack of nephritic colic, not followed by the discharge of a calculus.

Examination per vaginam enables us to feel a stone or stones, and also to judge as to their number and size; especially when firm pressure is made on the bladder above the pubes. But it is by means of the sound that we gain the more precise information.

Prognosis.—In the supervention of septic infection and of ascending suppurative pyelo-nephritis exists the danger of calculus of the bladder. The existence of this condition before the operation adds largely to the risks of surgical interference, and to it is attributable the mortality, small though it be, which follows lithotrity as now practised by skilled hands. The spontaneous expulsion of calculi in the case of men cannot be reckoned upon; but women pass large stones through the urethra, and others still larger sometimes escape into the vagina by ulceration of the vesico-vaginal septum.

Treatment.—In woman, owing to the absence of the prostate, lithotrity is said to be more difficult than in man; but this applies only to the operation in hands inexperienced in lithotrity in males. Lithotrity is, however, rarely required in women, because of the capacity and dilatability of the urethra. In women with stone of a large size, vaginal cystotomy, followed by immediate sutures, is an easier, safer, and more satisfactory operation than the hypogastric operation. In female children, the best operation is lithotrity by means of a lithotrite of the calibre of a full-sized catheter (No. 12 or 14), followed by the evacuation of the fragments with Clover's or Bigelow's evacuating bottle (aspirator). In adult women the same operation may be employed for stones which are too large to be safely extracted through the urethra in their entire state; or the fragments of the stone may be removed with forceps through the dilated urethra, as in the so-called mixed operation in males.

METHODS OF DIRECT EXAMINATION OF THE BLADDER

Vesical Palpation.—The urethra having been rapidly dilated by bougies, Kelly's tubes, or by one of the varieties of female urethral dilators, the index-finger of the surgeon is passed into the bladder. Much can be learnt in this way by actual palpation as to the condition of the bladder-walls and the ureteral orifices, and as to the presence and nature of a foreign body or vesical new growth, if any such exists.

Vesical Inspection.—Inspection of the interior of the bladder can give information as to the state of the mucous membrane of the organ, whether congested, œdematous, ulcerated, or otherwise; as to the presence or absence of a new growth, and as to its nature if one is present; as to the state of the orifices of the ureters, whether normal, absent, strictured, dilated, prolapsed, ulcerated, or the seat of a villous growth; as to the manner in which the urine enters the bladder from the ureters, and as to whether the urine as it enters the bladder is normal in appearance or tinged with blood or pus. In cases of ureteral fistula, information will also be thus afforded as to the side involved.

Vesical inspection can be made (1) by means of light thrown directly into the bladder along a tube (an endoscope) passed through the urethra; (2) by the cystoscope, which carries an electric lamp at its vesical extremity.

Inspection by aid of External Light, i.e. the Endoscope.—Inspection through the endoscope may be either by Grünfeld's method, which is by means of light reflected by the ordinary laryngoscopic frontal mirror, from a gas jet or electric lamp held opposite the examiner; or, following Stein, by directing the light along the endoscopic tube from an electric lamp fixed above and between the eyes of the observer by a strap and buckle surrounding the head. The endoscopic tubes may be either open at their ends or closed by glass.

The bladder is washed out. The patient is in the lithotomy position with the buttocks raised high, or she is in the knee-breast position. The tube, well anointed with boroglyceride, is introduced into the bladder, and the light is directed through the tube.

H. A. Kelly's method consists in (1) an atmospheric dilatation of the bladder induced by posture; (2) the introduction of a simple straight speculum, as a rule of small size and without fenestra; (3) the examination of the bladder and ureteral orifice by means of a reflected light, or an electric head-lamp (*vide* p. 69).

The patient, having her bowels well opened, her bladder emptied naturally, and being preferably in a state of fasting, is placed either in the elevated (that is, with the buttocks raised) dorsal, or in the knee-breast position. The dorsal position is the most convenient and least tiring to the patient, but is only serviceable in thin patients; the atmospheric expansion of the bladder is not good in this position. For a fat woman the knee-breast position is requisite, as the bladder will not distend in the elevated dorsal position.

A conical urethra dilator is first introduced, and afterwards a speculum, which is a simple metal cylinder 3½ inches long and of equal diameter throughout, with a funnel-shaped expansion at the outer end; the diameter varies in different tubes. A tube of a size suitable to the dilatability of the urethra is selected, and as soon as the speculum is introduced air rushes into and distends the bladder. The light is now transmitted along the tube, and the inspection of the bladder and of the ureteral orifice is commenced.

Inspection by aid of Internal Light, i.e. the Cystoscope.—With the cystoscopes of Nitze, Leiter, Casper, or Albarran, the greater part of the bladder can be inspected either in the male or female; all parts, in fact, except a small area of the posterior wall of the region of the immediate neighbourhood of the neck of the bladder, *i.e.* immediately behind the urethral opening. Nitze, to overcome this, constructed a second (No. 2) and a third (No. 3) cystoscope, in which the window and prism are placed at the anterior surface of the beak, and at the summit of the angle formed by the beak and body of the instrument, instead of in the angle formed by the beak.

In using the cystoscope, the patient is on her back, with the thighs well bent up; the bladder is washed out with antiseptic fluid, and five to six ounces of boracic solution are injected and left in the cavity. Then the cystoscope is introduced like a catheter; and if it be one with the prism at the summit of the angle formed by the beak and the straight shaft of the instrument, the beak must be directed upwards when within the bladder. After giving it a little lateral inclination, and moving the instrument slightly backwards and forwards, the orifices of first one and then the other ureter can be brought into the field of vision.

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H. M.

DISEASES OF THE EXTERNAL GENITAL ORGANS

Vulvitis

The vulva may be regarded as differentiated into two distinct regions: the outer or cutaneous, and the inner or mucous. The former swarms with all kinds of micro-organisms, whilst the latter is in health relatively free from them.

But in spite of the constant presence of pathological micro-organisms the vulval tissues are comparatively seldom invaded by them, and this is due to their efficient protection on the cutaneous aspect by the horny layer, and on the mucous surface by the compound scaly epithelial covering and the vaginal discharge with which it is bathed. The resistance of these tissues may, however, be overcome by unusual virulence of the infective material, by a change in the structure of the tissues themselves, or by both these causes combined.

The gonococcus, the Klebs-Löffler bacillus, and some other micro-organisms can invade the unbroken mucous membrane; but in most cases, even where these micro-organisms are concerned, an alteration in the condition of the surface is necessary to permit of its invasion. Such an alteration is produced by a wound or abrasion, or by its maceration. Wounds and abrasions, besides those occurring in childbirth and from accidents, burns, scalds, and powerful caustics, may be produced by scratching, coitus, masturbation, and gynæcological manipulations; and if the wounds thus produced be inoculated by dirty fingers, sponges,—which always contain septic material,—dirty linen, or unsterilised implements, inflammation will result. More commonly, however, vulvitis is due to maceration and excoriation of the surface by uterine and vaginal discharges; such as leucorrhœa due to vaginitis or endometritis, lochia, and a profuse, prolonged, or putrid menstrual flow. The putrid discharges caused by neglected pessaries and vaginal tampons, as well as those which proceed from sloughing cancers and myomata, are productive of considerable irritation and abrasion, and are a direct cause of inflammation; for not only has such a discharge lost its antiseptic qualities, but it is directly septic. Contact with ammoniacal and saccharine urine and fæces, especially in cases of vesico-vaginal and recto-vaginal fistulæ, has a similar irritating effect. In infants the condition is generally due to want of cleanliness and constant contact with decomposing urine and fæces. In older children oxyurides wandering into the vagina from the rectum lead to scratching and rubbing, and the wounds thus produced often become infected and inflamed. At all ages gonorrhœa is a frequent and important cause of vulvitis; and the epidemics which occur in schools are most probably attributable to it. The importance of gonorrhœa in women was pointed out by Nöggerath a quarter of a century ago, but has only recently received the attention which it deserves (*vide* p. 552). According to Sänger, 12 per cent of all the women who consult a gynæcologist suffer from gonorrhœa, and Veit estimates that three-fourths of the cases of vulvitis are due to it. Gonorrhœal-vulvitis, if by this term we understand a vulvitis due to gonorrhœa, is the commonest of all inflammations of the vulva; but if we restrict the term to those cases in which the disease is directly due to the invasion of the epithelial layer by gonococci, it is rarely met with, except in children. The reason for this is that in adults the gonococci are either unable to penetrate the thick horny layer of epithelium, or are rapidly destroyed if they do so. Bumm declares that there is no such thing as chronic gonorrhœal vulvitis, the disease in this position always disappearing—in adults very rapidly; even acute cases are rare. In ten years he met with but three genuine cases of gonorrhœal inflammation of the vulval mucous membrane in adults: two in very young women, and the other in a woman of forty-five. What is commonly known as gonorrhœal vulvitis is a secondary inflammation due to the stagnation in the vulva of pus derived from the urethra, glands, and the upper regions of the genital canal.

Symptoms.—Objective.—In acute vulvitis the labia, glans, and frenulum clitoridis are swollen and œdematous, and the surface is covered with pus. On separating the labia the mucous membrane appears bright red in colour and covered with pus and whitish patches; when this is removed a raw-looking surface remains. The hymen is red and swollen, the inguinal glands are enlarged and tender, and the neighbouring parts excoriated and inflamed. In true gonorrhœal vulvitis the specific micro-organisms are found in the pus and epithelial cells, which is not the case in the secondary or common form.

The little glands which exist in the folds of the hymen and fossa navicularis, and the vulval glands are often infected, and appear as numerous purulent nodules—*folliculite vulvaire blennorrhagique*—in them the disease is generally chronic. They are detected by the bright red spots at the orifices of their ducts, and on pressure a little pus or mucus can be expressed.

The glands of Bartholin are generally engaged, but the disease, so far as is at present known, is confined to the execretory duct, the gland substance remaining intact. This duct is easily obstructed and becomes distended with secretion, generally pus, and forms a retention cyst or pseudo-abscess (Jadassohn). When, however, other pyogenic micro-organisms gain access, such as the staphylococcus pyogenes aureus, which penetrates the connective interglandular tissue and causes suppurative destruction of the entire gland, a true abscess results. The symptoms caused by this condition are not, as a rule, very striking; by careful examination the bright red orifice of the inflamed duct is found and some greenish yellow discharge can be expressed; a certain amount of hardness can also be detected by the finger. In chronic cases the two small red spots (*macula gonorrhoica*, Sänger), indicating the orifices of the ducts, are generally apparent, and even when no fluid can be expressed, if the finger or a piece of cotton-wool be firmly pressed down upon the orifice and then slowly withdrawn a string of mucus sometimes follows it, which on examination is generally found to contain multitudes of gonococci. Such a condition may continue for years without causing any marked symptoms; occasionally the orifice becomes occluded, the discharge collects in the duct, and a retention-cyst is formed which may become as large as a pigeon's egg. It occupies the lower part of the labium majus, and protrudes inwards towards the vestibule; the skin becomes red and shining, stretched over, but not adherent to the tumour, and in the course of a few days it bursts—generally on its inner aspect. The greater number of cases of so-called abscess of Bartholin's glands are not really so, but are only retention-cysts, and when the contents are clear, and there is no attendant inflammation, they are generally recognised as such. Under certain conditions in uncleanly persons, in connection with menstruation or pregnancy, and from traumatism, pyogenic organisms other than gonococci find their way into the dilated ducts and produce a true abscess. The symptoms in that case are much more acute. The patient becomes feverish, there is stabbing, throbbing pain, the inguinal glands swell, and she finds difficulty in walking.

The *subjective* symptoms of acute vulvitis are generally a feeling of heat and burning in the vulva, often accompanied by intense itching; movement, by causing a rubbing of the inflamed parts against each other, increases the distress, as also does the act of micturition; standing and sitting also cause discomfort, so that the patient usually lies upon her back with her thighs apart. These symptoms seldom last long, but may continue in a diminished degree for some time, or pass into a chronic form.

I will not attempt to classify the various forms of vulvitis, but some may be distinguished:—

Gonorrhœal vulvitis is characterised as a rule by the presence of urethritis, inflammation of the glands of Bartholin, with consequent formation of cysts and abscesses, and in chronic cases the macula gonorrhoica; of these Veit says that they are as usual as they are characteristic; warty condylomata also are seldom if ever present in other forms of inflammation; but even where all these complications are present the only positive proof is the discovery of the gonococcus. The failure to discover this micro-organism, however, by no means proves that it was not the original cause, and other facts must be taken into consideration in forming a diagnosis; as for example the sudden appearance of inflammatory disease in a newly-married woman which injures her health to a degree out of all proportion to the local condition, the presence of granular vaginitis and salpingo-perimetritis, habitual abortion, sterility acquired after the birth of one child (Sänger), and ophthalmia neonatorum.

Dermal vulvitis is generally found as a complication of that of the mucous membrane, and is due to the same causes. The skin is excoriated by the irritating discharges, and looks raw and inflamed. When it occurs between the labia majora and the thigh it is known as eczema intertrigo, and is most frequently met with in very fat women. This condition is due to vaginal discharges, and probably also to sweat and sebaceous matter which collect in this groove, and by decomposition become exceedingly irritating and give rise to scalding and inflammation. After repeated attacks the skin remains darkly pigmented.

Sänger has suggested the name of vulvitis pruriginosa as a substitute for pruritus vulvæ. But however desirable it is to give a name which defines a pathological condition, instead of one which merely calls attention to a prominent symptom, yet in the present state of our knowledge as regards pruritus vulvæ we are scarcely justified in going so far as to accept this term as including all cases.

Veit considers that vulvitis due to masturbation may be distinguished as a separate form of the disease, and may be diagnosed by the following signs:—The lesser labia, or the clitoris and its prepuce, are elongated; the inner surfaces of the labia minora show a marked increase of sebaceous follicles which protrude above the surface. The surface of the mucous membrane between the hymen and labia minora, and that of the vestibule about the urethra, is often covered with small warty excrescences, which, however, are quite different from condylomata; they never branch, are confined to the mucous surface, are not infectious, and they occur generally in virgins with nervous hysterical symptoms. The generally intact condition of the hymen in these cases, as well as the social position and bearing of the patient, are against any idea of the condition being due to sexual intercourse. No evident cause is discoverable, and the condition is associated with hypersensibility and an excessive prudery. When in addition to these symptoms the inflammation is of an intermittent character, the membrane being found bright red at one examination and pale greyish pink at another, and when during the manipulation a clear viscid discharge exudes from the glands of Bartholin, the diagnosis is, to say the least, very probable. Closely related to this condition is the chronic vulval irritation met with in women whose husbands are impotent, or nearly so, and which is generally associated with vaginismus. In these cases also small warty growths develop which are excessively tender.

Aphthous vulvitis or thrush is generally associated with the same form of vaginitis, and is characterised by white membranes, without loss of substance. It is due to the oidium albicans, or other fungi which commonly infest the vagina, but are generally innocuous owing to the natural resistance of the tissues. Many other inflammatory affections occasionally occur in the skin of the vulva—erythema, eczema, herpes, furunculosis, and erysipelas, but as they differ in no way from the same affections in other places they do not require special notice.

Syphilitic affections occur frequently, but are more properly treated of in works on that subject.

Diphtheritic inflammation, complicating the same disease in the throat, has been reported by Winckel, Zweifel, and Fritsch. A case occurring in the puerperium has been recorded by Whitridge Williams, in which the baby and also another child died of diphtheria. v. Herff described cases resembling hospital gangrene.

Noma pudendi is a name applied to gangrene of the vulva occurring in young children, especially after the exanthemata, and resembling noma of the face, which occurs under similar circumstances. It commences with burning local pain and fever; the tissues swell, becoming dusky red, brown, grey, or black; bullæ form upon the surface and burst, discharging a thin, ichorous serum, and a dark slough is exposed. The disease is generally fatal; but should the patient recover, there is marked deformity from cicatricial contraction.

Two cases of **actinomycosis** of the vulva have been recorded, one by Lieblein of Prague and the other by Bongartz of Düsseldorf. In the latter the disease occurred in the larger labium, causing suppuration and fistula. When the latter was scraped out the actinomyces were discovered.

Sequelæ of vulvitis.—Adhesion of the labia in young children, a condition which was formerly attributed to arrest of development, or supposed to have occurred during intra-uterine life, is believed by Veit to be invariably the result of a vulvo-vaginitis in early infancy. He believes that this vulvitis is almost always gonorrhœal, but might possibly in some cases result from other forms. The inflamed surfaces become raw and granulating, and, being closely pressed together, become adherent. In adults this is prevented, or the adhesions are immediately broken down, by the patient's walking about; but in infants, where this does not occur, the adhesion becomes permanent. On examination a thin membrane is found between the labia, with always one and sometimes more openings in it. If there be an opening at the posterior commissure, little trouble results; but if there be a single aperture at the anterior margin of the adhesion, urine is liable to enter and stagnate in the vagina, causing considerable irritation.

Prognosis.—From what has gone before it is evident that vulvitis is generally a secondary affection, and that the prognosis depends chiefly upon the primary cause: where this is removable, the secondary condition gets well of itself; where it is not, the condition admits of palliative measures only. In gonorrhœal cases a cautious prognosis is always advisable. In general terms, however, the disease may be regarded as curable so long as it has not extended to the uterus and its appendages.

Treatment.—In acute vulvitis, especially of gonorrhœal origin, the first indication is to keep the parts at rest, and with this object the patient should be confined to her bed. Sexual intercourse is to be forbidden not only for this reason, but also to avoid any risk of fresh infection. The greatest danger in such cases is the extension of the disease upwards, and therefore all local interference which might in any way tend in that direction, as for example gynæcological manipulations, vaginal examinations, the passage of specula or sounds, and especially vaginal douching or syringing, are to be avoided. Warm compresses of boric acid or permanganate of potash, or dusting the parts with iodoform or iodoformogen, are at least harmless. As the condition becomes less acute, warm baths and the application of ointments consisting of lanolin and some mild antiseptic are advisable. In chronic cases the vulva should first be thoroughly cleansed as if for an operation, and this should be done by the medical attendant himself, or by a thoroughly competent nurse—the parts being well scrubbed with soap or lysol and hot water; and in the former case bathed with a disinfectant, such as the biniodide of mercury. In very chronic cases salts of silver, the nitrate, or some of the more modern preparations, such as protargol, are generally necessary. In vulvitis due to irritating discharges which cannot be checked, as in cases of incurable fistulæ and cancer, palliative measures are alone possible, and that generally adopted is to cover the excoriated surface with some thick ointment, such as the following:—℞ Resorcin, gr. x.; pulv. amyli, lanolini, vaselini, zinci oxid, āā ℥ij. In cases of thrush boric compresses are generally sufficient. Treatment of complications is mostly dealt with elsewhere; but it must be here pointed out that as they stand in the relation of cause, and the condition under consideration is as a rule only the result, their discovery and treatment is in most cases the all-important factor in effecting a cure. Condylomata are, however, an exception to this rule, and their removal is part of the local treatment of vulvitis. It is generally done with scissors or a knife; but Veit prefers to scrape them away with a curette, and to cauterise the raw surface with nitric acid. This method, he says, causes much less hæmorrhage than simple excision. Carbolic and nitric acid alone may be effective where the number of condylomata is small, but in large tumours excision is the only rational treatment. Dusting with savin has been recommended, but is useless.

In cases due to masturbation the hypertrophied nymphæ should be removed, and where, as is usually the case, there is endometritis also, the uterus should be curetted.

PRURITUS VULVÆ

The objection to the retention of this name is that it suggests a symptom only, and not a pathological condition. It is, in fact, a relic of the past, when symptoms were used in classification—as for example leucorrhœa, dysmenorrhœa, menorrhagia. Now these are no longer regarded as diseases, but are treated as symptoms only. The same should be the case with regard to pruritus, which is a recognised symptom in many diseases of the vulva; but occasionally, and that, too, in the worst cases, no definite local cause is discoverable, and this has led to a wide and somewhat confusing diversity of opinion. Olshausen, for example, held that it was a neurosis, and distinguished those cases in which an evident cause existed as "symptomatic," and those rare cases in which no cause was discoverable as "essential."

Schultze believed that pruritus was occasionally a purely reflex phenomenon. Prof. A. R. Simpson described an idiopathic form of it; Beigel and Zweifel regarded it as being sometimes due to unknown changes in the nervous system; Bronson, as a nervous dysæsthesia; Jaggard, as a reflex nervous disorder of sensation without structural change. Webster considered that pruritus is due to a chronic fibrosis, especially of the nerves and their terminations in the clitoris and nymphæ.

Sänger adopted Webster's views, and considered that the symptom is always referable to local inflammatory changes, and proposed to substitute some name such as inflammatory neurosis of the vulvar corium, or dermato-neuritis-vulvæ-pruriginosa, or, briefly, vulvitus pruriginosa. Dr. Herman's views are very similar to those of Sänger, and I am inclined myself to believe that such views will finally prevail; but I do not think that we should be justified, in the present state of our knowledge, in accepting a new term which would imply a final settlement of a vexed question which is still far from being so determined.

Veit agrees with Sänger in rejecting an essential or neurotic form of pruritis; he disagrees with him, however, in admitting endogenous or hæmatogenous causes, such as icterus, nephritis, diabetes, morphine, alcohol, and iodoform—all of which, he thinks, act locally and never through the circulation, and are therefore not endogenous at all, but exogenous causes. As to Webster's views, he thinks they add little to our knowledge. We already knew that there are local inflammatory changes which are generally regarded as secondary, and he can see no reason for regarding them as primary.

Symptoms.—The one subjective symptom is a burning, tickling, itching sensation in and about the labia, but especially in the clitoris and its immediate neighbourhood, which sometimes spreads over the mons veneris, thighs, and anal region. The itchiness is seldom constant, but mostly occurs in paroxysms, is aggravated by warmth or motion, and is most marked at night. So intolerable at times does this irritation become that women affected with it can hardly refrain from scratching, even in public; and the nervous condition is so aggravated by sleepless nights that some of these unfortunate patients, driven to despair, have actually committed suicide. The local conditions generally found are characteristic. The skin is thickened, looks dull and harsh, is abnormally white in places, and of leathery consistence; so that when a fold is drawn up it remains for some time before it sinks again to its former level. The surface is covered with small fissures and scratches, and the hairs are broken off short. Microscopically there is a general thickening of the epidermis, and, under the rete Malpighii, a small-celled infiltration. Webster described a progressive fibrosis of the nerves and nerve-endings, which he considered as the primary cause of the symptoms, but most authors regard all such conditions as secondary, and mostly the result of rubbing and scratching.

To summarise the views at present held upon this subject, we may say that pruritus is generally regarded merely as a symptom caused by some local condition, but that it is believed by some authors of high repute to be in some rare cases a pure neurosis, or a reflex symptom of some more or less distant condition, or due to some abnormal condition of the blood. That it is ever due to such causes is doubted by most authorities, who consider that a local cause exists in every case, however difficult it may prove in some to discover it.

In the majority of cases pruritus is a symptom of vulvitis, and its causes are the same, and have been already described. One, however, is so frequent and of such importance that it requires especial mention, namely, diabetes mellitus. Pruritus vulvæ is such a common and early symptom in this disease, that it should be laid down as an axiom that in every case where this symptom is present the urine should be carefully examined for sugar. Some authors are of opinion that in this disease the itching is due to the condition of the blood, but it is much more probable that it is caused by contact of the saccharine urine, which rapidly decomposes and becomes very irritating.

Prognosis.—Depends upon the discovery of a cause; where this is possible, and the cause removable, the prognosis is generally good; but even in such cases relapses are frequent, and caution is therefore advisable.

Treatment.—The treatment of the original cause is the most important point. The general health, therefore, requires careful consideration; diabetes, gout, and rheumatism should be considered, the alimentary canal should be disinfected, and the feeding of the patient carefully regulated. In children worms require especial notice, and all irritating urine and vaginal discharges are to receive the treatment elsewhere described. Even where the cause is obscure, however, benefit has resulted from the administration of bromides and arsenic.

The local treatment is generally the same as that already recommended in vulvitis, but, to relieve the itching, stronger applications are generally required—antiseptic lotions, especially carbolic acid in various strengths, perchloride of mercury, or creolin, nitrate of silver, or tincture of iodine. Powdering with iodoform or dermatol are amongst those most frequently employed. Scanzoni recommended a liniment composed of 1 part chloroform to 30 of oleum amygdalæ; Duke, menthol in stick; and More Madden, methylene-blue. Cocain ointment gives temporary relief, and electricity has been tried with apparent benefit in the form of galvanism or the high frequency current.

Where the primary cause has been removed, but the local changes remain in spite of prolonged and careful treatment, especially where those changes are limited to certain circumscribed areas, the excision of the diseased structures, as first recommended and successfully carried out by Schroeder, is the best and most rapid method of effecting a cure. It must, however, in no case be forgotten that the primary cause is first to be discovered and removed, and that only in cases where this has been done, and where, as will very rarely be found, the local condition resists all medicinal local treatment, its removal is not only permissible, but advisable.

Professor Hirst of Pennsylvania thinks that division of the nerves supplying the skin of the vulva is better surgical treatment than its removal. This was first attempted by Sir James Y. Simpson, and has since been tried by others, but according to Hirst in an imperfect manner. He has cured three inveterate cases by the resection of the genital branch of the genito-crural, the ilio-inguinal, the perineal branches of the pudic, the dorsal nerve of the clitoris, and the inferior or long pudendal nerve on both sides. To do this four separate incisions were required: two over the external inguinal rings through the deep fascia, and two along the inner edges of the ascending rami of the ischia from the tuberosity to a point two inches above it. The nerves were not only divided, but as long a peripheral end as possible was pulled out. If the clitoris is involved in the pruritus it is necessary to resect its dorsal nerve, which requires a deep dissection of the ischio-rectal fossa, through the inferior layer of the triangular ligament; the nerve is found to the inner side of the ascending ramus of the ischium on the outer side of the artery.

KRAUROSIS VULVÆ

This condition was first described by Breisky in 1885. It is characterised by an atrophic shrinking of the skin of the vulva and neighbouring perineum, in consequence of which the folds of the nymphæ disappear, and the skin is drawn smoothly over the surface. It is dry and shining, and assumes a white appearance; is exceedingly brittle, having lost its elasticity to such a degree that the gentlest manipulations, such as separating the parts for inspection or the introduction of a finger into the stenosed vaginal entrance, may cause deep gaping fissures. Much more extensive injuries are, of course, likely to result from coitus and childbirth.

In Breisky's cases the disease caused little subjective disturbance; in Martin's there was intense pruritus and burning sensations, especially on passing water. In the cases described the histological examination by Orthman showed the skin atrophied, especially the rete Malpighii, which in some places remained only in patches, in others had entirely disappeared. The papillæ were flattened out or had disappeared; the corium was stretched and sclerosed, forming rigid cicatricial tissue, showing in places a small-celled infiltration, which was more marked in the deeper layers; there were no sebaceous follicles and very few sweat-glands. At the edges, however, near the sound skin the tissues were rather hyperplastic, the horny layer and rete Malpighii thicker, the papillæ broader, and, as well as the corium, infiltrated with small cells. There was no change in the nerve-endings, and the most careful examination as well as culture experiments revealed no specific bacillus which could be regarded as the cause of the condition. The nature and causation of this disease is still obscure. Martin and others regard it as essentially distinct from all other affections hitherto described. The urine in none of his cases contained either albumen or sugar; there was no hereditary tendency, nor any other skin affection present, nor any syphilitic origin traceable; one case only had had gonorrhœa. Sänger evidently connects it in some cases at least with pruritus, and Veit thinks that it is probably the last stage of that disease; and the absence of itching in some of the recorded cases he is inclined to attribute to concealment due to shame on the part of the patients, and a fear of being accused of masturbation.

Diagnosis.—Veit considers that a radical distinction between kraurosis and pruritus is not always possible. In the former the fissures are less obvious, and the line of demarcation between the diseased and healthy tissues more sharply marked. The disease involves the entire vulva, whilst in pruritus it often occurs only in patches. If the entire vulva is involved in pruritus, and at the same time the vestibule narrowed, he can see no points of distinction.

Prognosis.—A spontaneous cure is hardly to be expected, and local applications have rarely been followed by any beneficial results. Its complete removal by operation has, on the other hand, generally resulted in a cure; and as cancer has supervened in some cases, this may be regarded as an additional reason for urgently recommending this radical procedure.

Rodent Ulcer

Lupus vulvæ and esthiomène are names which are somewhat loosely applied to ulcerations of the vulva accompanied by hypertrophy; amongst these rodent ulcer, a condition described by Schroeder as an ulcerative process, commencing on the posterior commissure in the fossa navicularis and extending into the perineal body, is more definite. The surface of this ulcer is irregular, the margin sharply differentiated from the healthy tissues; the surrounding mucous membrane, including the remains of the hymen, is hard and swollen; narrow fistulous passages lead into the rectum, the opening into the bowel being usually at the top of the perineal body where the vagina is in close relation with it. There are usually several openings on the perineal surface; the fistulæ becoming united as they extend deeper, and having a common opening into the rectum; beneath this opening the bowel is ulcerated and contracted as in syphilitic stricture. The anus is surrounded by a ring of hard swollen piles, usually of a whitish colour. The labia majora are swollen, feel hard to the touch, and incompressible. When they are separated numerous red spots, generally associated with gonorrhœa, especially those connected with the openings of Bartholin's ducts, are observed. Where the ulcerative process has invaded the urethra and its neighbourhood the same kind of process as already described extends inwards along the urethra. Finally, the canal is laid open by destruction of its lateral walls, so that it resembles the condition of the cervix where an ectropium has resulted from bilateral rupture; *i.e.* the posterior lip hangs downwards over the hymeneal opening, the anterior remains *in situ* but is exposed to view. The mucous membrane thus exposed becomes altered in character, being covered with scaly epithelium. What remains of the canal is very short, and its inner orifice is contracted by cicatricial tissue.

Anatomical examination shows a chronic inflammatory process, but nothing characteristic; in some cases giant cells were found.

Etiology.—This condition has been observed almost exclusively in prostitutes, and Schroeder attributed it to infection and mechanical injury.

Koch considered that extirpation of the inguinal glands was the chief cause, but this has not been proved to be the case. The term lupus vulvæ suggests a tuberculous origin; but, excepting a few doubtful cases, this has not been verified by microscopic examination: tubercle bacilli are certainly not an essential condition in this disease. In most of the cases there was a history of syphilis, so that this must be accepted as at least a predisposing cause.

Diagnosis.—*Elephantiasis.*—Many authors regard these affections as identical, and Koch describes the rodent ulcer as an elephantiasis due to lymphatic obstruction. The peculiarities of the disease are the simultaneous occurrence of ulceration and hypertrophic indurations.

Tuberculous ulcerations are altogether different in size, situation, and appearance; and the microscope reveals giant cells and tubercle bacilli.

Cancer very seldom affects the navicular fossa: its appearance is different, it bleeds more easily when touched, and the microscope reveals its malignant nature.

Prognosis.—This disease does not directly endanger life nor affect the general health to a marked degree, but the chance of cure is generally unfavourable. Where it is in an early stage, however, and involves the urethral region only, a cure is possible, but such cases are rarely met with. Where there is much hypertrophic enlargement of the labia, ulceration of the fossa navicularis, with perforation and stricture of the rectum, a cure can hardly be hoped for.

Treatment.—In the very early stages absolute rest and cleanliness may suffice; where these fail, destruction of the diseased structures with strong caustics, such as nitric or sulphuric acids, caustic potash, or the actual cautery, is indicated. Hypertrophic tissues are to be cut away and the wounds closed by suture, cicatrices divided with a knife, and the wounds closed by sutures so inserted as to approximate the ends of the cut. The rectal stricture should be treated by extirpating the constricted portion along with the ulcerated fossa navicularis, drawing down the upper end of the divided bowel and fixing it to the skin. A. Martin reports success from this method.

ELEPHANTIASIS ARABUM

This is a disease seldom met with in these countries. It is caused by hyperplasia of the skin and subcutaneous cellular tissue. The hypertrophied labia majora form large tumours, which hang down sometimes to the knee. The surface is sometimes smooth and shining (elephantiasis glabra); sometimes covered by innumerable warty growths (elephantiasis verrucosa or papillomatosa) (Fig. 161); sometimes the swelling feels hard and firm, in others soft. According to Cornil and Ranvier there are histologically three principal forms:—

1. In the first the entire derma is hypertrophied, and returns to the embryonic condition. In the midst of this there are dilated lymph-spaces.

2. In the second form, which often succeeds repeated œdema, the engorgement of the tissues extends over a large area owing to stagnation of lymph accompanied by fibrous alteration of the glands.

3. The third variety is chiefly remarkable for the enormous thickening of the skin, involving all its structure. In all three the predominant lesion is a dilation of the lymphatics.

Etiology.—Very little is known of the causation of this disease, but that it is endemic in certain countries points to infection; it usually begins between the ages of fifteen and forty, but has been known to occur in infancy. In this country it is generally a sequel of syphilis or soft chancre, especially in cases in which the glands have been destroyed or removed. That it is not influenced by antisyphilitic treatment is against its being regarded as directly due to that disease; rather, as Veit suggests, is it probable that syphilitic patients are predisposed to elephantiasis and rodent ulcer.

Symptoms.—In hot climates the disease often commences as an acute affection; but in these countries it is always very chronic, and causes little discomfort excepting that resulting from the size and weight of the tumour, which may give rise to difficulty in walking, cohabitation, defæcation, and micturition.

Diagnosis.—The disease may be confounded with other hypertrophic skin diseases associated with ulceration, especially rodent ulcer and cancer.

In the latter the ulceration is more extensive, and there is a tendency to hæmorrhage which is absent in elephantiasis.

Prognosis.—Elephantiasis is essentially a chronic disease, and, complications apart, does not endanger life. However, it causes so much discomfort as to demand relief.

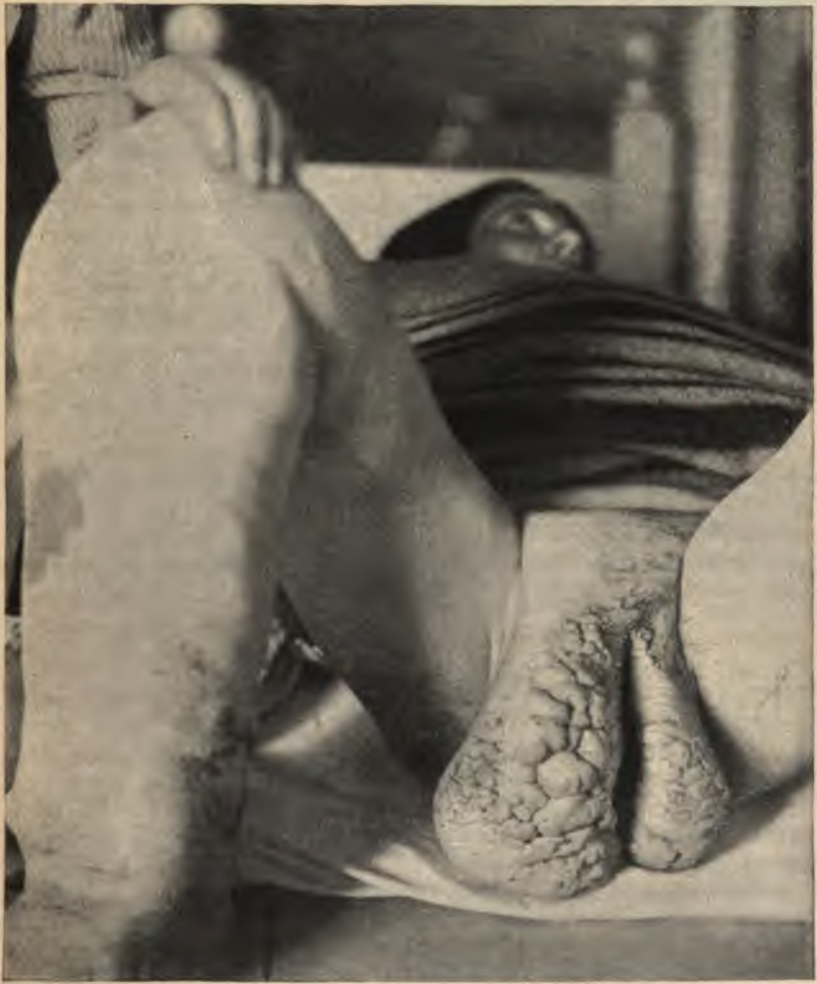

FIG. 161.—Elephantiasis. From a patient of Dr. Andrew Horne.

Treatment.—The only treatment hitherto successful is total removal of the diseased structures. In performing this operation hæmorrhage and suppuration have to be especially guarded against. Schroeder introduced a procedure which has been generally adopted, and which effectually prevents any serious loss of blood. Beginning at the posterior limit of the disease, he cuts it gradually away, closing the wound made by each cut with suture before proceeding further. In this way he prevents any serious loss of blood; but, according to Veit, primary union is seldom secured by strictly following this plan, the failure in his opinion being due to tension, and also to the retention of blood in the wound which favours suppuration. He therefore advises to remove as little skin as possible, and to tie the bleeding vessels separately before closing the wound, and also to be careful when doing this to insert alternately deep and superficial sutures. Professor Hirst advises the insertion of strong pins or skewers under the diseased mass, and before its removal to apply a rubber tube under them so as to diminish the blood-supply to the growth.

Tuberculosis has hitherto been observed only in the form of an ulcer, and never as a primary affection; cases have been described by Deschamps, Chiari, Demme, Zweigbaum, Compound, Viatte, Müller, and Emanuel.

The ulcer resembles similar ulceration in other places. It is irregular in form, with undermined eroded edges, and a greyish base formed of caseating material.

Treatment.—As the disease has never so far been discovered as a primary affection, local treatment, excepting of a palliative kind, would have been useless.

The three conditions with which we have just been dealing are closely related to each other, and are frequently found associated in the same case, but they can hardly be regarded as identical.

VAGINISMUS

This name was given by Marion Sims to a condition in which reflex cramp of the muscles of the pelvic floor, due to an abnormal hyperæsthesia of the external genital organs, occurs on every attempt at sexual intercourse, and is generally a complete hindrance to connection. It would be a mistake, however, to consider the term vaginismus as synonymous with dyspareunia; it is a frequent cause of dyspareunia, but not by any means the only one.

The explanation of the phenomenon may be that it is a primary neurosis, without any local cause, which produces such an abnormal sensibility of the parts that cramp of the muscles results from any irritation of the vulva; this view is supported by the fact that it occurs almost exclusively amongst women of the upper class, and is almost unknown amongst the very poor. It is more probable, however, that it is not a primary, but a secondary or developed neurosis. It is especially apt to occur in nervous, hysterical, hyperæsthetic women who will not endure the slightest pain, and who shrink from the ordinary discomfort of a first coition. When the act is satisfactorily accomplished this soon passes away, but when it is not there is great danger of vaginismus; both parties become nervous and anxious, and many fruitless attempts so aggravate the condition that at last coitus is abandoned as hopeless. When medical assistance is sought it is found that the conditions present vary much. Often a direct cause for the abnormal sensibility of the vulva is easily discovered: it may be a vulvitis or a fresh gonorrhœal infection, or cracks in the imperfectly ruptured hymen which have become infected and inflamed; in other cases there may be a urethral caruncle. Schroeder considered that it was often caused by the vulva being placed abnormally forward, so that the penis pressed directly against the clitoris or the tender urethral orifice. Such a malformation is not often found; but in nervous women contraction of the levator ani muscles draws the perineum towards the pubes and displaces the vulva forwards. In some cases, especially where no attempt has been made at sexual intercourse for some time, nothing abnormal can be discovered. In some an examination can be carried out without difficulty, and one or two fingers introduced without causing spasm, and yet the nervous excitation of sexual intercourse will produce it; and this is especially apt to occur where the husband is not altogether potent, either through age, nervousness, too frequent intercourse, or masturbation. In the vast majority of cases, however, any attempt at examination will produce the cramps, with marked evidences of pain and nervous excitement; the buttocks being lifted off the couch, and the thighs forcibly approximated. It is then necessary to administer an anæsthetic. If nothing is discovered the condition is generally attributed to a primary neurosis. A careful consideration of the facts already stated and of the results obtained by treatment will, however, lead to a different conclusion, namely, that it is not a primary, but an acquired neurosis. If the diagnosis is uncertain it is a good plan when making an examination under an anæsthetic to allow the patient partially to recover consciousness, when in true vaginismus the spasm will immediately recur, to disappear when the anæsthesia is rendered more complete. A peculiar phenomenon nearly related to vaginismus was first described by Hildebrandt, namely, a cramp of the levator ani muscles during coitus, by which the penis is held tightly until it subsides, and similar cases have been recorded by others. Many authors, however, refuse to admit such cases, but I can see no reason to doubt their occurrence; a case has been recently recorded by Fritsch, in which he was obliged to chloroform the woman before the penis could be set free.

Prognosis is generally good, provided the treatment be carefully carried out; but it should always be guarded, as hysteria or reluctance to persist in treatment on the part of the woman, or impotence on the part of the husband, have to be taken into consideration.

Treatment.—The general nervous condition requires special attention: tonics, fresh air, cold bathing, and bromides are generally required.

Locally, any tender or inflamed parts should receive appropriate treatment, but this is possible only in cases of minor severity. In the more severe cases the local treatment must be directed, in the first place, to the dilation of the hymeneal ring; and, secondly, to keep it patulous, and especially to persuade the patient that the vulva is no longer tender. To accomplish the first object the patient is anæsthetised, and the perineum incised half-way to the anus; two lateral incisions in the vagina are made to meet the upper end of this cut, forming a Y; this wound is united by sutures placed from above downwards; the result is a gaping vulvar orifice resembling that of a parous woman. The second object is secured by careful after treatment, which is commenced as soon as the wound has firmly united, and consists in the introduction of dilators. This must be done with the greatest care, as the slightest pain will produce a mental anxiety which will postpone the cure indefinitely. At first a pledget of cotton-wool soaked in a 4 per cent solution of cocain is placed in the vulva and allowed to remain five minutes, then a Hegar's dilator, No. 15, well warmed and oiled, is cautiously and slowly passed into the vagina and secured by a T-bandage; it is allowed to remain for an hour. Next day a larger size is introduced, and the process repeated until a dilator 3 cm. in diameter can be easily introduced. The process is then repeated with weaker cocainisation, and lastly without the use of cocain. At last, when a dilator of 3 cm. (1¼ inch) can be easily introduced without cocain or lubricant, the patient may be dismissed as cured. This is the best and most certain means of cure, but in some of the milder cases dilatation alone without a cutting operation will suffice.

VULVAR SWELLINGS

Cysts.—*Cysts of Bartholin's Glands* are almost always of gonorrhœal origin, and may contain pus or a clear viscid or watery fluid. In most cases the duct only is affected, but occasionally the entire gland is implicated. The signs and symptoms have been already described. Such cysts are usually small tumours the size of a plum or less, but sometimes they reach extraordinary dimensions; in Veit's opinion, however, large cysts are referable rather to Gartner's ducts than to Bartholin's glands. Köbner found fatty matter and a calcareous shell in one case which Zweifel regarded as a dermoid; that it was so is, however, doubtful. But dermoids do occur in the skin of the vulva as elsewhere, also lymphatic and sebaceous cysts; and the cysts of the vulvar mucous membrane are chiefly of the latter kind. Peckham described a cyst of the clitoris which contained sixty grammes of a chocolate-coloured fluid. *Cysts of the hymen* were first described by v. Winckel; they are usually met with on its outer surface towards the fossa navicularis. Palm regards them as sebaceous cysts; and Veit agrees with this view, and rejects that of Klein that they are connected with remains of Gartner's tubes. Schaeffer believes that every hymen is formed of two layers, and that by union of their edges a space may be formed which may develop into a cyst. Such cysts, though interesting to pathologists, are of no clinical importance. Lastly, cysts of the vulva may be connected with the round ligament or the canal of Nuck.

Hernia.—Inguinal hernia, though much less common in women than femoral hernia, is not very rare. The bowel descends through the canal of Nuck into the greater labium, when it is called hernia labii majoris anterioris, in contradistinction to another form of labial hernia which is exceedingly rare, and is termed hernia labii majoris posterioris. The latter may occur in one of two ways: firstly, the hernia may descend in front of the ligamentum latum, distending the vesico-uterine fold of peritoneum and passing down between the bladder and uterus along the vagina into the labium (vagino-labial hernia), or it may descend behind the ligamentum latum between the rectum and vagina into the labium or into the perineum. Such a hernia might contain the uterus and ovaries

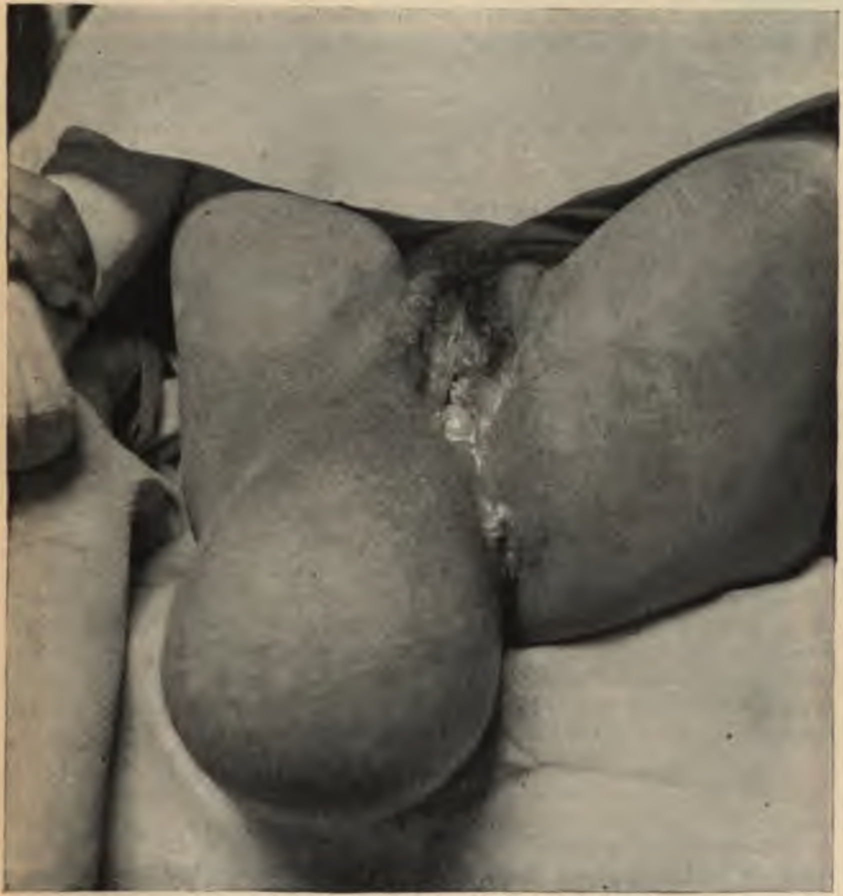

FIG. 162.—Hernia labii majoris posterioris. (W. J. Smyly.)

as well as the intestine and omentum. The diagnosis is of great importance, because a posterior labial hernia might very easily be mistaken for a cyst of Bartholin's glands. The accompanying photograph (Fig. 162), taken from a patient in the Rotunda Hospital, shows a large perineal hernia which had descended in front of the broad ligament. About half the contents could be reduced into the abdominal cavity, and as they again descended into the sac could be felt through the vaginal wall.

Varicocele is a common result of venous obstruction complicating pregnancy and abdominal tumours. The patients complain of a feeling of weight and distension, often attended by itching. The chief danger is rupture of a vein; cases have been recorded in which a fatal result followed this accident. Compression of the veins, so useful in varicose conditions in the lower extremities, is difficult to carry out in this situation. A T-bandage and compress are so inconvenient that they can only be adopted in the worst cases, and we are obliged to restrict our measures to rest in bed and the use of astringent lotions. In cases of rupture, hæmorrhage should be at once controlled by the application of a compress, and, as soon as the necessary preparations can be carried out, by ligature.

Hæmatoma, or Thrombus vulvæ, is not frequently met with except in pregnant and parturient women, and results from the rupture of a vein, generally from a blow or a fall against some hard object. An elastic tumour of a deep purple colour, which is neither hot nor tender, forms in the labium. This is accompanied by a feeling of tension and a desire to micturate. In non-pregnant women such tumours are not likely to attain a large size or to be attended with much risk to life.

Where the effusion is small in amount the application of an ice-bag is all that is required; but where the effusion is considerable the cyst should be laid open, and all bleeding points secured by suture, or the cavity firmly packed with gauze. In every case where symptoms point to putrefaction or suppuration, the cyst should be evacuated, its cavity disinfected, and treated in the manner described above.

Benign Tumours

Fibroids.—Fibromyoma, fibroma, and myoma usually occur as globular tumours, of more or less firm consistence, sharply defined from the surrounding tissues and covered by normal integument. They are most frequently found in the labium majus, or hanging from it by a pedicle, and consist as a rule of fibrous tissue with a few unstriped muscular bundles (Fig. 163). Such tumours probably originate in connection with the round ligament, as was pointed out by Sänger; and this view is supported by their analogy to fibroma of this structure, by the discovery that they generally have a small pedicle traceable in an upward direction to the inguinal canal, and that their blood-supply comes from that direction. As a variety of fibrous and myomatous tumours may be mentioned molluscum pendulum, which resembles the same disease in other places. Garrigues removed a fibromyoma from the left labium majus; Brigidi, a rabdo-myomyxomatous growth; Villers and Damage, a calcified fibroma of the right labium majus. Cysto-fibromata have also been recorded.

Treatment.—Their liability to undergo sarcomatous degeneration is a reason for removing these tumours; and besides, they cause considerable inconvenience owing to their size and weight, and interference with coitus.

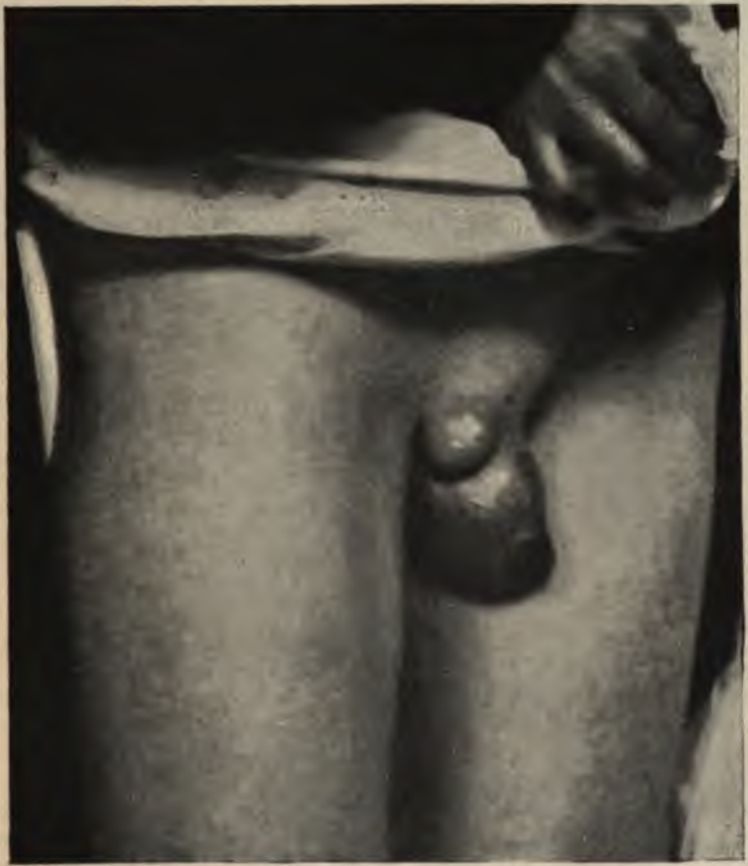

FIG. 163.—Fibromyoma of larger labium. (From a patient of Dr. Henry Wilson.)

When the tumour is pedunculated the pedicle is to be ligatured and the tumour removed; when situated in the substance of the labium it should be enucleated, and the cavity stitched up or drained. When controlling hæmorrhage after enucleation it should not be forgotten that the blood-supply comes from the inguinal canal or round ligament, and the vessels should be looked for and secured in the upper part of the cavity.

Lipomata are rather uncommon in this position; they are soft tumours, generally with a capsule, and most frequently situated in the larger labium or hanging from it by a pedicle, or on the mons veneris.

Graefe described a lipoma which sprang from the subserous fat between the vagina and descending ramus of the pubes, and followed the same route as a hernia labialis posterior; it had existed ten years, and was the size of an adult's head. Balls Headley described a lipoma, the size of a duck's egg, which was situated in the left labium in the neighbourhood of Bartholin's gland. It consisted of fat and connective tissue, and was connected by a constricted portion with another tumour under the vaginal wall, the size of a banana, which extended so far upwards that the os could not be reached with the finger. A third part of the tumour was situated over the left ischium. Quénu records a lipoma in an infant of five months. In all cases extirpation is advisable.

Enchondroma.—In 1855 Schneevogt described a case which exhibited a cartilaginous appearance on section, and which may possibly have been an enchondroma of the clitoris.

Neuromata.—It is a disputed point whether the very tender spots which have been described as neuromata can be accepted as such; the two cases reported by Kennedy and Simpson in 1859 and 1874 were probably not of this nature, and since then no fresh cases have been recorded.

Angiomata are exceedingly rare in this situation. Hening and Sänger have each recorded one case.

Malignant Tumours

Cancer.—Of all the regions of the female genital organs the vulva is the least often affected with cancer. Schwarz met with 30 cases of vulvar to 1147 of uterine cancer. The disease most frequently commences in the clitoris, in the groove between the labia majora and minora, or in the perineum, and latterly it has been found to originate in the glands of Bartholin; in the last situation it takes the form of adenocarcinoma, in the others of epithelioma. The disease first appears as a nodule, which quickly ulcerates (Fig. 164). The tumour generally grows rapidly, accompanied by ulceration and diffuse infiltration of the surrounding tissues. The inguinal glands are early involved, but not in all cases. In most cases the course is rapid, whilst in some it is very chronic; in all there is a marked tendency to ulceration and infiltration of the connective tissues, and the disease soon involves the bones, especially the descending rami of the pubes. Fritsch called especial attention to the frequency of a periurethral extension. The opposite labium often becomes affected where it comes in contact with the disease; and there is rapid extension to the mons veneris and perineum, and up the vagina.

Symptoms.—Pruritus often precedes the development of cancer, but it is an open question whether it is an early symptom of this disease or a predisposing cause, since Martin, Czempin, Schwarz, and Jacobs have shown that chronic pruritus or kraurosis show a marked tendency to develop carcinoma; and it is quite comprehensible that out of the anatomical changes caused by pruritus, carcinoma may develop. An observant patient may detect the indurated nodules before ulceration takes place, but in the vast majority of cases this is the first sign that attracts attention. When pain is a prominent symptom, the cellular tissue has become so infiltrated with the disease that the time for successful removal has generally gone by.

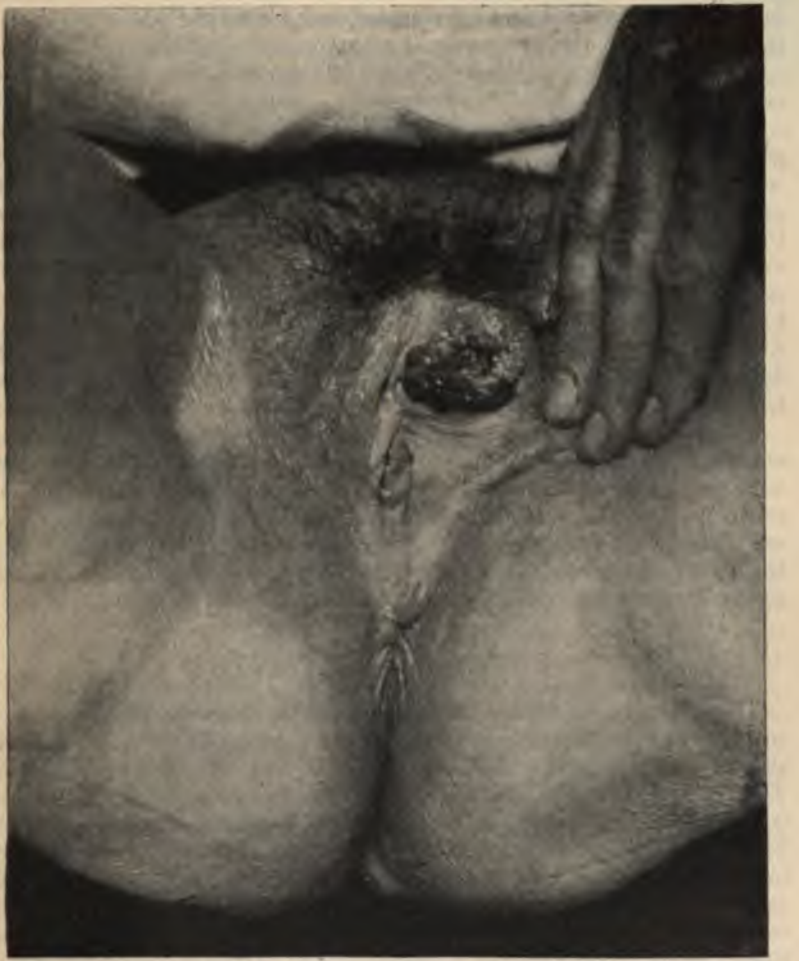

FIG. 164.—Epithelioma of left labium majus. (From a patient of Dr. Henry Wilson.)

Diagnosis is usually easy, but in doubtful cases excision and microscopic examination will assist.

Ulcerated fibromyomata, lipomata, neglected syphilis, lupus, and elephantiasis have been mistaken for cancer. The last, especially when the infiltration is extensive and the surface ulcerated, resembles carcinoma; but in cancer, hæmorrhages are frequent and severe, and where the disease is extensive it is always associated with a general cachexia.

Prognosis is bad, but less so than in vaginal cancer, and permanent cures have been reported in some cases.

Treatment.—Where the disease can be entirely removed, excepting perhaps in very old women, it should be extirpated. This is best done with the knife, though some operators prefer the thermocautery. The excision should be carried at least half-an-inch wide of the disease. In order to do this it may be necessary to cut down to the bone, and even to remove parts of it. It has sometimes been found necessary to remove the entire urethra, and then a new urethra has to be formed, and for this purpose transplantation of skin may be required. Alberti and Zweifel have successfully restored the urethra in such cases. Where the disease cannot be entirely removed it is better to avoid operative interference altogether, and to treat the case by palliative measures only.

Sarcoma.—The number of recorded cases is small, and amongst them melanotic growths are relatively frequent. In the labium majus they occur as hard, circumscribed tumours, indistinguishable from fibroma, except by their more rapid growth and microscopic characteristics, or as soft, rapidly growing tumours. The spindle-celled variety has been most frequently met with. V. Winckel reported a round-celled sarcoma the size of an adult head, also a case of myxosarcoma.

DISEASES OF THE VAGINA

In structure the vaginal mucous membrane resembles the skin, and is covered with compound scaly epithelium, but it differs from ordinary skin in being as a rule destitute of glands, and having a moist surface. The lower part of the canal is more or less in contact with the air, and is liable to the entrance along with the air of a number of micro-organisms. These organisms have excited a great amount of interest, and repeated investigations have been instituted to determine their importance in the causation of disease. Such investigations were first undertaken in connection with puerperal fever, to determine the possibility of autoinfection in the puerperal state. Kaltenbach was of the opinion that micro-organisms which entered the vagina during or before pregnancy might subsequently develop a virulent character, which presupposes that the vagina offers a habitat in which they can live for months. Steffeck and Winter admit this possibility, because they found streptococci and staphylococci in vaginæ which had not been touched for a long time. Ahlfeld went even further, and declared that in every vagina there are micro-organisms which under favourable conditions can cause fever and death.

Döderlein found in half the cases he examined a whitish grey material, of the consistence of clotted milk, of intensely acid reaction, and containing an almost pure culture of an organism which he named the vaginal bacillus. Of other micro-organisms the oidium albicans and the yeast fungus could occasionally be detected. Saprophytes were rapidly destroyed in this material, probably by its acidity; it never yielded pathological germs by culture; and its injection into animals was followed by negative results. This he called the normal discharge. In the other cases he found what he called a pathological discharge; it was of a yellow or greenish yellow colour, of a creamy consistence, sometimes frothy or mixed with viscid mucus, feebly acid or even alkaline in reaction, and contained various micro-organisms. The essential distinction he drew between normal and pathological discharges was that whereas in the former saprophytes perished rapidly, the latter formed a medium peculiarly favourable to their growth.

Krönig scouted Ahlfeld's views, and declared every vaginal discharge to be free from pathological as well as putrefactive germs. This he attributed to—

1. The bactericidal power of chemical agents in the discharge, possibly the acid.
2. The antagonism of vaginal germs to those imported.
3. Phagocytismus.
4. Absence of oxygen.
5. Mechanical cleansing.

Walthard made a series of careful examinations in 100 cases; in only 14 of these he found a normal secretion as described by Döderlein, and in 25 out of 27 cases in which streptococci were present the reaction was acid. Not only are these results contrary to the conclusions of Döderlein, but entirely upset those of Krönig, and the final results of his investigations are more or less a return to Ahlfeld's opinion, that the streptococci found in the vaginæ of women who have not been examined for some time are not virulent, but merely saprophytic; but that in tissues of depressed vitality, as those which have been crushed during a long and difficult labour, or in nephritis, syphilis, diabetes, anæmia, and fevers, they may assume a virulent character. From all these more or less contradictory observations, we may for practical purposes conclude that although the vaginal discharge is not so eminently bactericidal as Döderlein and Krönig had led us to believe, it is in most cases, at least, antagonistic to the growth and development of pathological micro-organisms.

Vaginitis, or Colpitis.—Inflammation of the vagina is due to infection, not necessarily a direct invasion of the vaginal tissues by micro-organisms, though this does occur; but the microbic infection may take place elsewhere, as, for example, in the cervix or uterine cavity, and the discharge thus produced may cause vaginitis owing to its irritating qualities. A vaginitis may therefore be due to a direct invasion of the mucous membrane of the vagina, or a secondary irritation by discharges.

The micro-organisms which can invade the mucous membrane are the gonococcus, Loeffler's bacillus, the streptococcus of erysipelas, septic germs, and fungi, such as the leptothrix, oidium albicans, monilia albicans, monilia candida, and yeast fungi. The mere presence of these micro-organisms in the vagina, however, is not sufficient to cause inflammation, for many of them, especially the fungi, are frequently found in a healthy vagina; so that something more is required to account for the occasional invasion of its tissues by these organisms, namely, a weakening of the natural protection or resistance to invasion. This weakening may be due to individual peculiarities, to infective diseases, to maceration by irritating and infective discharges, to wounds and injuries, or to venous stasis and congestion. Or, on the other hand, it might be due to the quantity and virulence of the infective matter, or to its repeated introduction. It is, however, of importance to distinguish direct invasion of the tissues from irritation due to discharges. Let us take, for example, vaginitis due to gonorrhœal infection. The vagina was formerly held to be the commonest seat of this disease, and is still so regarded by many, especially by Veit; but Bumm and others consider that, excepting in young children, an invasion of the mucous membrane by gonococci is an occurrence of extreme rarity.[1] He found not only in chronic, but even in acute cases also, that when the cervical discharge was excluded by a gauze tampon, that which exuded from the vagina contained no gonococci; and, further, that examination of pieces of excised mucous membrane showed intact epithelial covering, and no gonococci, and that cases in which infective material was kept in contact with the living membrane for twelve hours yielded a negative result—it did not become inflamed. From these observations he at first supposed that gonorrhœal vaginitis did not ever occur in adults. Since then (1880) he has met with a true gonorrhœal vaginitis, resembling that occurring in children, in five cases; and he therefore now admits that, under exceptional circumstances, the vaginal mucous membrane, even in adults, may be so modified as to allow of its invasion by gonococci. But chronic gonorrhœal vaginitis he has never seen; and granular vaginitis, which is accepted by many as a form of chronic gonorrhœa, he believes has nothing to do with that disease, and quotes Martineau in support of this contention. Veit, on the other hand, maintains that not finding gonococci in the tissue is no proof of their absence, since they are always difficult and often impossible to detect. We may, however, conclude that the gonococcus can produce vaginitis in two ways: firstly, in children and in some adults by directly invading the mucous membrane; and, secondly, by infecting the cervix and uterus, and producing a secondary or simple vaginitis by the irritating chemical constituents of the discharges thus produced. Other organisms which produce irritating discharges will act in a similar manner, as, for example, in putrid endometritis, sloughing myoma and cancer of the uterus. Inflammation thus produced is, however, much less common than is generally supposed, and, according to Veit, is more likely to occur where irrigation is employed than in cases which are not interfered with; this he attributes to maceration and injury to the membrane by carbolic acid or other disinfectant employed. Foreign bodies introduced into the vagina, especially when septic matter is carried in along with them, are likely to cause vaginitis; pessaries, for example, when imperfectly sterilised, or left in too long, produce catarrh which usually subsides after their removal, but if neglected or forgotten, ulceration, deep infection, and paravaginitis, or fistula may result. What has been said of pessaries applies with even greater force to other foreign bodies introduced by the patient herself, since no precautions to insure their cleanliness are observed. A pessary may, however, cause inflammation, even though aseptic at the time of introduction, if made of some irritating material, such as soft rubber or wood; or if it causes undue pressure by fitting badly, when it is too large, or changes its shape after introduction, as sometimes happens in the case of celluloid rings; or by being allowed to remain too long. In such cases they are apt to cause catarrh and exfoliation of the epithelium. In a similar manner chemical agents used for therapeutic purposes may cause vaginitis, for example, strong solutions of carbolic acid or chloride of zinc; or thermic causes, such as too hot a douche, or the thermo- or actual cautery. Glycerine tampons too frequently inserted, or left in too long, will also cause inflammation; and, lastly, mechanical causes such as masturbation, or too energetic efforts to render the canal aseptic before operation.

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[1] This point is more fully discussed in connection with gonorrhœal infection (see p. 557).—Ed.

Inflammation is especially likely to occur at the menstrual period, during pregnancy, or after childbirth; in women with a gaping vulva and vaginal prolapse, also in young children, and in old women after the menopause.

Anatomical changes.—The inflamed vaginal mucous membrane is generally red and swollen, with elevated spots or nodules. In acute cases, where the swelling is general and the elevations less marked, these are not obvious, and can be more easily felt with the finger than seen with the eye; this is especially the case in young people, where the entire surface is of a bright red colour, and the elevations can only with difficulty be detected on the tops of the rugæ. The older the patient the less intense, as a rule, is the general redness, and the contrast in colour between the pinkish surface and the bright red papillæ is more evident. In patients who have passed the climacteric the surface is pale and the prominences less marked; often there is a pale yellow membrane with numerous red spots like ecchymoses which are not elevated at all above the surface. In some very chronic cases there is no change in the colour of the membrane, but only prominences which can be detected better with the finger than the speculum, and in using the latter it is a good plan to move it about so as to vary the illumination.

Microscopic changes.—The prominent red spots consist each of a group of inflamed papillæ, which are so altered by a round-celled infiltration that they appear as broad masses of connective tissue. These round-celled infiltrations often extend below the papillary body, and are found in all the layers of the membrane. The epithelial layer is very thin on the top of the prominences, but thicker between them, and, as in all cases of round-celled infiltration, there is increased vascularity. In senile cases the extent of surface involved is much more limited and the vascularity less marked; the bright red spots are due to thinning of the epithelium over subepithelial infiltrations.

Varieties of Vaginitis.—(1) Catarrhal; (2) granular; (3) senile or adhesive; (4) membranous; (5) aphthous; (6) ulcerative.

Catarrhal vaginitis is the ordinary form, in which there is generally a uniform redness, and the prominent spots are not markedly distinct from the surrounding surface.

Granular vaginitis is the term applied to those cases in which the prominences are easily distinguished both by touch and sight, and form the chief feature of the disease; this condition has been generally accepted as indicative of a gonorrhœal origin, an assumption which has been seriously shaken by Bumm and others.

Senile Vaginitis, Vaginitis Vetularum vel Adhesiva.—This form, as its name implies, is peculiar to women who have passed the menopause. In it the membrane is smooth and reddish, or pale and atrophied in patches which are denuded of epithelium; and these denuded surfaces tend to grow together, forming firm adhesions. In some cases the fornices become entirely obliterated by their surfaces growing together, or by their adhesion to the cervix; in other cases the adhesions occur so low in the vagina that the cervix can be neither felt nor seen. When recent, these adhesions may be broken down and the natural shape of the vagina restored; but, as a rule, this will be found impossible. This form of vaginitis is so common that few women over sixty will be found without some adhesions.

Membranous Vaginitis.—In addition to the ordinary signs, a membrane forms which is often firmly adherent to the surface beneath it. It consists of coagulated fibrin containing a number of round cells and micrococci, and is often associated with a similar condition of the intestine. Eppinger, Griffiths, and others have described such cases. V. Winckel described a membranous vaginitis, in which there was a greyish white membrane, as colpitis gummosa. This membrane, when examined by Birch Hirschfeld, proved to be the exfoliated mucous membrane. After the slough was cast off the process repeated itself several times; Winckel was inclined to attribute the condition to syphilis. Klebs described diphtheritic vaginitis in childbed, and a similar condition resulting from cholera, variola, and scarlatina. Lwow met with a croupous vaginitis, and Eppinger a membranous vaginitis in a case of dysentery.

Ulcerative Vaginitis.—Ulceration most frequently results from pessaries and other foreign bodies, and is not infrequently met with in cases of procidentia. Soft chancres and gangrenous ulcers occasionally occur. A rare form of ulceration was described by Zahn as *ulcus rotundum simplex.* The ulcer, situated in the posterior fornix, was circular in shape, with a sharply defined non-indurated edge and a red base covered by thin pus. He was inclined to attribute it to want of blood-supply, as the arteries were sclerosed, and those leading to the ulcer altogether obliterated. Beuthner, Browicz, and Skowronski agree with Zahn as to the causation of these peculiar ulcers, but Braithwaite thinks they are caused by micro-organisms.

Aphthous Vaginitis, Colpitis Mycotica, or Thrush.—Vaginitis is sometimes caused by micro-organisms of a higher order than bacteria—fungi which commonly flourish in the vagina, but only occasionally give rise to inflammation. It is characterised by the appearance of white patches upon a moderately red surface. When examined microscopically, these membranes are found to contain the oidium lactis, monilia albicans, monilia candida, leptothrix, and occasionally a yeast fungus; there is small-celled infiltration, but always quite superficial, and there are none of the little prominences found in the other forms of vaginitis.

Symptoms of Vaginitis.—The chief symptom is discharge, which varies both in amount and character. In acute gonorrhœal infection there is a copious discharge of yellow or greenish pus. In less acute inflammations it may consist of pure mucus, but this is generally mixed with so much cellular matter that it appears white; sometimes it is thin and serous, in others milky or frothy. In the aphthous form there is little discharge, the vagina being as a rule abnormally dry.

In all forms the symptoms which force the patient to seek medical aid are due to complications,—vulvitis, urethritis, etc.—so that in most cases there is a burning and itching about the vulva, the itching being especially intense in the aphthous form.

Diagnosis is generally easy by means of the finger and speculum; to the former the vagina feels hotter than normal in acute inflammations, and the little miliary prominences can often be felt. Through the speculum the discharge can be obtained, and after its removal the local changes already described are observed. In aphthous vaginitis a speculum can scarcely be tolerated, but as this disease is generally limited to the introitus it can be seen by simply separating the parts with the fingers.

Prognosis.—Vaginitis may be regarded as a curable disease in every case in which the cause is remediable. The prognosis is doubtful in gonorrhœal cases, because the disease in the uterus and Fallopian tubes, to say nothing of the husband, may not be curable; and it is absolutely bad when it is due to persistent irritating discharges, as in incurable fistula and cancer.

Prophylaxis.—Amongst prophylactic measures the most important are—firstly, to caution men suffering from gonorrhœa against marrying for at least two years from the time of infection; and it is almost as important that a woman who has been infected with gonorrhœa should cease to cohabit with her husband until both have been cured (*vide* p. 554). The third point is the importance of asepsis in minor practice, the avoidance of routine douching, and care in the employment of pessaries, plugs, specula, and other instruments.

Local treatment.—In treating a case of vaginitis the method to be pursued will vary not only with the form of inflammation present, but also with the condition in which it is found, whether a fresh infection or a condition of long standing. The first duty of the practitioner will generally be to discover, and if possible remove, the cause of the inflammation. He should remove pessaries, tampons, and other foreign bodies; cure fistulæ, and treat cervical and other diseases which cause the vaginitis. Exceptions to this rule are cases of acute gonorrhœal and septic inflammations which involve the uterus, for in such cases it is advisable to commence the treatment by rendering the vagina as aseptic as possible, and so to minimise the risk of carrying the infective matter upwards and causing an extension and aggravation of the disease.

It must be remembered, also, that a fresh gonorrhœa will generally get well if left alone, and that any manipulation is liable to cause its extension. In acute and subacute inflammations the best treatment usually is the insertion of glycerine plugs. These should always be inserted by the medical attendant, or a well-trained nurse, through a speculum, and should not be pushed in by the patient herself. Various substances may be combined with the glycerine, such as ichthyol or protargol (10 per cent), the latter being especially useful in gonorrhœa; and in more chronic cases, boric acid, tannic acid, and alum. Where the medicament has to be introduced by the patient herself, pessaries are preferable; these are made of cocoa butter, or gelatine and glycerine, containing the antiseptic or astringent applications desired. This method is more popular than it would otherwise be owing to the facility with which it can be employed by the patient herself; but oily substances are bad vehicles for antiseptic remedies, and when made with glycerine and gelatine, which is the form that I prefer, they require considerable skill in manufacture, otherwise they may melt between the fingers before they can be introduced into the vagina, or they may not melt at all, and be voided unchanged; very useful pessaries are those which contain pure glycerine. Vaginal irrigation is the form of treatment most generally employed, but is by no means advisable in all cases; in gonorrhœa, for example, there is always a risk of carrying the disease upwards. Veit thinks that douching is seldom beneficial, and is only useful as a palliative by washing away discharges. When douching is employed the following precautions should be observed:—A douche and not a syringe should be used; the vessel containing the fluid should not be placed at a greater height than two or three feet above the patient's vulva; and a glass vaginal tube, which is kept clean and frequently boiled, should be employed. Various antiseptics and astringents are applied in this way: corrosive sublimate (1 in 2000), biniodide of mercury, carbolic acid 2 per cent, creolin 1 per cent, boric acid 3 per cent, permanganate of potash, chinosol or formalin 1 per cent; in chronic cases sulphate of zinc 1 per cent, or acetate of lead 0·2 per cent. In such cases, however, the fluid is applied better by means of a speculum, the patient lying upon her back; it is poured into the speculum, and as the latter is withdrawn slowly every part of the vagina is bathed by it. Besides the substances already mentioned, crude pyroligneous acid of commerce, which is one of the most useful remedies, and in gonorrhœal cases solution of nitrate of silver, may be applied in this way. In some cases benefit results from painting the surface of the vagina with tincture of iodine. In other cases dry treatment, as advocated by Sänger, is best; the vagina may be plugged with iodoform gauze, or powdered with tannin, dermatol, or alum and sugar in equal parts.

In the mycotic form the treatment must be actively antiseptic. Douches afford little relief; it is better to apply boric acid lotions to the vulva on absorbent cotton-wool or lint, and to renew these compresses frequently, and as soon as a speculum can be tolerated to apply lotions of corrosive sublimate, sulphate of copper, or nitrate of silver in the manner already described.

Colpohyperplasia cystica, or emphysematous vaginitis, is a peculiar condition of the vagina first described by v. Winckel. It occurs most frequently in pregnant women, and usually disappears during the puerperium. It consists in the formation of numerous tiny cysts containing gas, which appear as little white translucent prominences upon the deep purple of the vaginal surface. To the eye they appear to contain fluid, but they disappear upon pressure with the finger, and when punctured no fluid but a little gas escapes. The first step towards elucidating the nature and causation of these cysts was taken by Zweifel, who suggested that they were due to some putrefactive germ because he found trimethylamin, a putrefactive product, in the gas. This was denied by Breisky, but Zweifel repeated his experiments, and both he and Hilgar found trimethylamin. C. Ruge found that the gas existed in spaces in the cellular tissue, and not in glands as suggested by v. Winckel. Eisenlohr discovered bacteria in the connective tissue surrounded by a small-celled infiltration. He also found lymph capillaries plugged with bacteria in the commencement of cyst-formation; the larger the cysts the fewer bacteria they contained. He inoculated culture media with material from these cysts, and found that in feebly alkaline media short rods developed which produced gas until the medium became acid, and when this was neutralised the gas-production recommenced; from this he concluded that the disease is due to these gas-producing organisms, and that the gas thus produced expands the lymphatics and presses lymph and bacteria into the neighbouring tissues. Strauss, under Klein's direction, tested the work of Eisenlohr and fully confirmed his views. The cysts he examined microscopically were generally surrounded by connective tissue, seldom by epithelium, and the micro-organisms were found only in the neighbourhood of the cysts.

From this it appears that the disease is an emphysematous vaginitis due to an infective germ, so far as is known at present a bacillus.

Treatment.—Glycerine tampons, or the application of solutions of boric acid or corrosive sublimate.

Garrulitas vulvæ is a term applied to a very disagreeable symptom, namely, escape of gas from the vagina. This is accompanied by unpleasant sensations and sometimes an audible noise. It occurs in women with a patulous vulva; but generally there is no noticeable change in the vaginal mucous membrane, and it has generally been attributed to the entrance of air and its forcible expulsion when the position is changed. Veit thinks that this is not the true explanation, and that the frequent occurrence of frothy discharge points to a gas-forming bacterium. Löhlein, however, rejects this hypothesis because the gas is odourless.

The treatment consists in repairing the vagina and treating vaginitis if present.

Paravaginitis.—This means inflammation of the connective tissue surrounding the vagina. It is most frequently met with in childbed, but occasionally results from wounds under other circumstances, such as result from vaginal operations with defective aseptic precautions, from criminal attempts to produce abortion, and from neglected pessaries. In such cases an induration or phlegmon is felt under the wall of the vagina, which generally ends in suppuration and evacuation of the pus through the original wound, or an incision may be made for the purpose.

A much more important form, however, has been described as para- and peri-vaginitis phlegmonosa dissicans. In this affection the suppurative process undermines the vagina, so that a great part, or the whole, of the mucous membrane sloughs away. The process is attended by high fever and severe pain, and is generally followed by stenosis and atresia of the vagina. In one case the condition appears to have been the result of gonorrhœa (Syromiatnikoff), in another of enteric fever (Imukiewics), in another of enteric fever and pneumonia (Bross); in others no cause could be discovered (Marconnet and Wiegandt). It is probable that this affection may occur unobserved in children during infectious fevers, and account for atresia of the vagina, which is discovered later in life. The treatment is limited to assisting the separation of the sloughs and preventing stenosis.

Tuberculosis.—Vaginal tuberculosis is a rare affection, and is usually secondary to tuberculosis elsewhere, but two cases of primary tuberculous ulcer have been recorded by Thompson and Friedlander; the former is, however, somewhat doubtful. It is most frequently the result of uterine tubercle, and occurs on the posterior wall as a greyish, caseating ulcer, with irregular, serpiginous, sharply defined margins, surrounded by reddened infiltrated mucous membrane in which miliary tubercles may be seen.

Vaginal New Growths.—1. *Benign*:—Cystoma, myoma. 2. *Malignant*:—Sarcoma, carcinoma.

Cystoma.—Small vaginal cysts are comparatively common, those of large size rare. The former are often discovered quite unexpectedly when a patient is examined for some other cause, more frequently on the anterior than upon the posterior wall. They are generally single, but when two or more are present they generally occur in a row, not in groups; in size they vary from that of a pea to a cherry. The part of the cyst which protrudes into the vagina looks bluish white and translucent, contrasting markedly with the surrounding membrane. The amount of protrusion varies, the cyst in some cases assuming a polypoid form. Large cysts show a tendency to extend in the broad ligament up to or even above the pelvic brim; in some the tumour causes prolapse of the vagina on the one side, and reaches almost to the abdominal wall on the other.

Histology.—The smaller cysts are usually lined with a single layer of cylindrical epithelium, which is occasionally ciliated. Sometimes the epithelium is cubical, rarely squamous, not infrequently polymorphic, cylindrical in one place, scaly in another; endothelium is exceedingly rarely found. The cyst-wall is usually smooth or thrown into simple folds, but Kleinwächter found well-formed papillæ in some cases. Occasionally there is no proper cyst-wall nor epithelial lining, the connective tissue being simply separated by fluid. The contents consist of clear, thin fluid, or mucus. In large cysts it is often coloured, and contains epithelium, fatty detritus, and cholesterin crystals.

Origin.—The chief question with regard to the origin of vaginal cysts is their relation to embryonic structures and malformations. In all probability many of them develop from remains of the Wolffian ducts, and this has been rendered more probable since Klein was able in two cases to trace these ducts along the vagina as far as the hymen. The larger cysts, which extend upwards in the broad ligament, are most probably derived from these ducts and the parovarium. Freund thought that some cysts might originate in a double vagina; one half, being in a rudimentary condition and closed, becomes distended with fluid. It is exceedingly doubtful, however, that vaginal cysts ever originate in this way.

Small cysts are developed from vaginal crypts, but it is uncertain whether or not these crypts originated as vaginal glands; these v. Preuschen showed do occasionally exist, and were probably formed at a time when the vagina was lined with cylindrical epithelium, or represent remains of Gartner's ducts. Cysts due to dilated lymphatics could only occur as the result of colpohyperplasis cystica, the space being formed by the expansion with gas and subsequently filled with serum. Finally, cysts are found in connection with cicatrices.

Symptoms. — Small cysts cause no inconvenience; large ones may obstruct coitus or cause vaginal prolapse. The small cysts are so soft that when pressed by the examining finger they give the impression of a hole in the mucous membrane, and their bluish white colour is quite distinctive. The upward extension of large cysts is made out by bimanual examination.

Treatment.—This consists either in removing the protruding part of the cyst, as first recommended by Schroeder, and stitching the remaining mucous membrane to that of the vagina, or extirpating the cyst completely. The former is generally to be preferred, because much simpler and quite as effective, the interior of the cyst becoming in a short time indistinguishable from the rest of the vaginal wall. Occasionally, however, where the cyst is very large, or its interior papillomatous, it must be extirpated completely.

Myoma.—Vaginal myomata are very rare; they spring from the connective tissue, and resemble similar tumours of the uterus, but are not so distinctly encapsulated. They may become polypoid or slough.

Diagnosis.—They must be distinguished from uterine myomata, which grow downwards along the vagina; also from polypi, which become adherent to it.

A sloughing myoma resembles a cancer, but the latter is more friable and inclined to bleed, and the mucous membrane is involved in the disease. If any doubt remains, the microscope will remove it.

Treatment.—Polypi with a narrow pedicle are to be ligatured and cut off, all others enucleated.

Sarcoma.—Sarcoma is a disease of youth, most of the reported cases having occurred in patients under forty, and a large proportion of these in children.

In childhood the disease differs from that met with in adults, and, according to Veit, more closely approximates to cervical sarcoma in them than to the vaginal form. It generally grows as a polypoid mass, and has been compared to grapes or currants; it is usually of a bright or dark red colour, and generally springs from the anterior wall. It may be present at birth or commence soon after. The first sign is usually a protrusion of the growth through the vulva. There is an early tendency to slough and to spread rapidly over the entire mucous membrane of the vagina, soon involving the cervix and bladder. The disease is one of the most malignant that can be encountered, metastasis and sloughing being generally the direct causes of death. The vagina is often distended with pus, and pyometra and purulent peritonitis not infrequently supervene. Obstruction of the urethra by the tumour causes dilation of the bladder and ureters, and hydronephrosis; extension of the disease to the bladder leads to sloughing, purulent cystitis, and pyonephrosis.

Histology.—The usual sarcomatous cells are found: sometimes the tissue is hard and firm, the connective-tissue cells being relatively numerous—fibrosarcoma; sometimes it is mixed with mucoid tissue—myxosarcoma. Kolisko found striped muscular fibres in three cases.

Symptoms.—Generally the protrusion of the growth is the first symptom, but occasionally the child complains of pain in the region of the vulva or during micturition and defecation.

Diagnosis is most important, since an early and radical operation is the only hope of cure.

Prognosis is extremely bad: only two cases of radical cure have been reported.

In the Volkman-Schuchardt case a polypoid growth with a piece of the vagina was at first removed. After six and a half months, a second operation was undertaken for a recurrence of the disease. The tumour was drawn forward with volsella, and the entire lower half of the posterior vaginal wall removed along with the tumour. There was no recurrence after ten years.

Holländer's patient was only nine months old, and had had a bloody discharge for two months previously. He removed the tumour, which was the size of a pigeon's egg, and had it examined microscopically by Pick, who established the diagnosis of sarcoma. The entire vagina and the uterus were then removed by Israel by means of a parasacral operation. The child recovered, and was well at the end of ten years.

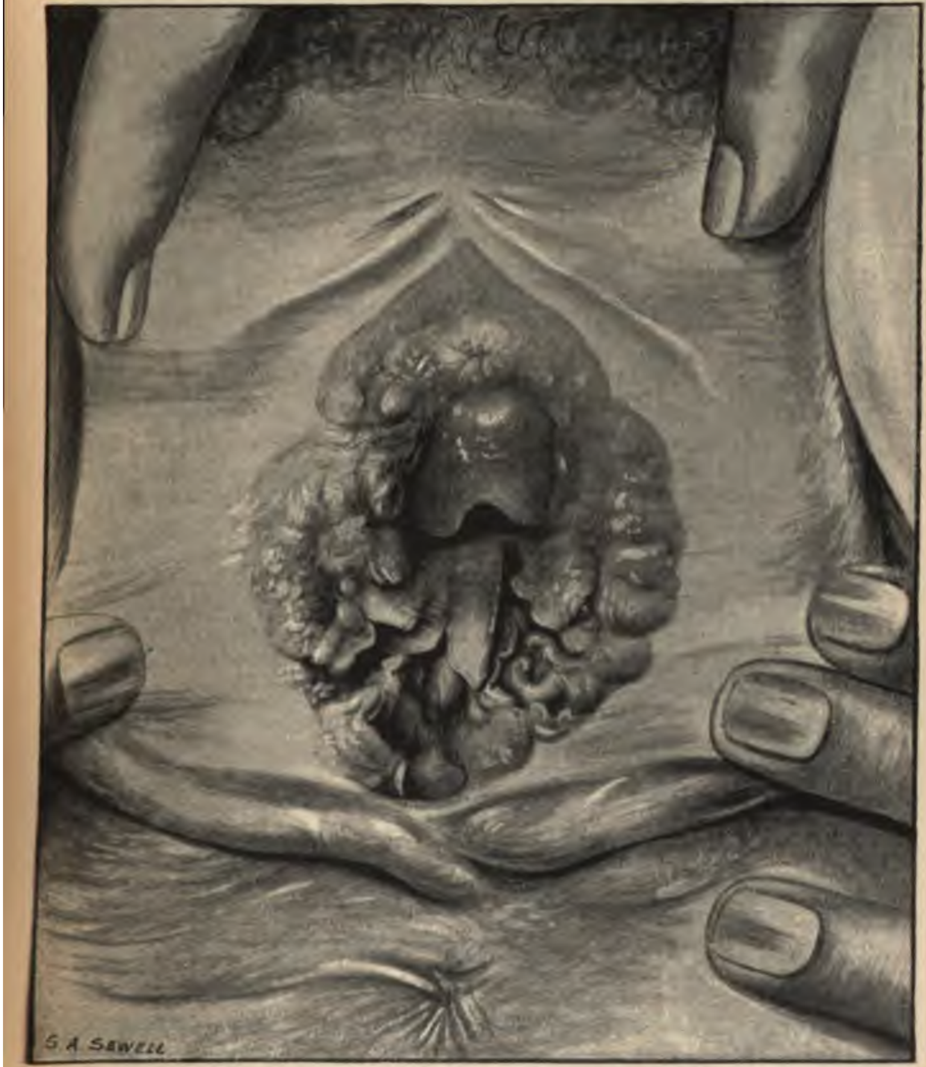

FIG. 165.—Sarcoma of the vagina. (From a patient of Dr. H. Jellett.)

From these cases it is evident that where the disease is diagnosed early, and a thoroughly radical operation performed, a cure may at least be hoped for.

Sarcoma in the adult occurs relatively seldom in a polypoid form, most often as a circumscribed tumour, which may appear on any part of the vaginal mucous membrane. In two cases only, so far as I am aware, it occurred in a diffuse form around the introitus vaginæ. One of these is recorded by Spiegelberg, the other by Dr. Henry Jellett, who has kindly supplied me with the accompanying illustration (Fig. 165).

Histologically these tumours are the same as sarcoma occurring in other places.

Symptoms.—The discovery of the tumour is often the first thing that calls attention; in other cases hæmorrhage and discharge, or pressure symptoms and tenesmus. The lymphatic glands are seldom involved.

Diagnosis. — These tumours have often been mistaken for myoma and carcinoma, and in most cases can only be distinguished with certainty by microscopic examination.

The *prognosis* is very bad. Seitz states that only three cases have been recorded in which the disease was removed and did not recur. These are Spiegelberg's, in which there was no recurrence after four years; Gatti's, in which there was no recurrence after several years; and Rubeska's case, in which there was none after eleven years. To this number Jellett adds two, namely, Morris's case, in which there was no recurrence after two and a half years; and Handfield-Jones's case, in which there was no recurrence after six years.

Treatment is the same as in carcinoma.

Vaginal carcinoma is a disease of advanced life, most commonly met with in women who have borne children. It is generally secondary to disease of the cervix, but occasionally is found as a primary affection; it then occurs on the upper part of the posterior vaginal wall, just below the cervix, as a circumscribed new growth very slightly elevated above the surface; but it is seldom discovered in this early stage, generally not until ulceration has occurred. This ulcer is crater-like in form, with an irregular, sloughy surface, and a hard, indurated base. Sometimes cancer of the vagina occurs as a diffuse growth involving almost the entire surface, and changing the dilatable elastic canal into a hard and rigid tube. This form, unlike the other, does not tend to extend deeply. Early involvement of the glands is common to both varieties.

Etiology.—Little is known as to the causation of vaginal cancer, but it has been found with relative frequency to follow the irritation caused by neglected pessaries.

Symptoms.—The growth bleeds when touched. There is a watery, fœtid discharge, and cachexia sets in early. The finger recognises the rough irregular surface, the surrounding induration, and the friability of the growth.

Diagnosis. — Difficulties may arise in distinguishing cancer from sloughing myomata, or simple vaginal ulcers with sprouting granulations, such as those caused by neglected pessaries, and especial difficulty may be found in reaching the disease where there is a stenosis below it, as not infrequently is the case in old women.

Prognosis is very bad; the ulcerative form spreads rapidly to the deeper structures, and very few cases of permanent cure have been recorded.

Treatment. — The entire vagina must be extirpated if possible, and since there will then be no canal left for discharges from the uterus this organ must also be removed.

Veit favours a transacral operation. The vagina is first isolated and the uterine arteries secured, and when all hæmorrhage has been controlled the vagina is then opened and the uterus removed. Zuckerkandl and Frommel operated through the perineum.

Olshausen recommended a transverse perineal incision and separation of the posterior vaginal wall from the rectum up to Douglas's pouch. The latter is then laid open, the uterus seized with a volsella, retroverted, and separated from its attachments. Lastly, the anterior vaginal wall is separated from the bladder. Where the disease has extended too far for a radical extirpation, palliative measures only can be employed, namely, antiseptic douches and morphia. Powerful caustics, such as chloride of zinc, are not advisable, as they are liable to produce fistulæ.

Foreign Bodies in the Vagina.—A great number of foreign bodies have been found in the vagina—glasses, cups, candles, reels, and the like, which have been introduced for sexual gratification; also hairpins, sponges, tampons, and pessaries which have been worn by patients for ten years and upwards, and have been completely forgotten. Entozoa may be introduced from the bowel; the ascaris lumbricoides, the oxyuris vermicularis, and the pulex irritans have been found, and in one case a grasshopper. Large foreign bodies compel the patients at once to seek medical aid; smaller ones remain to produce vaginitis with purulent offensive discharge mixed with blood, saprophytes, and other pathological micro-organisms, which cause a fœtid, irritating discharge resembling that of cancer. Not infrequently stenosis occurs in the vagina just below the foreign body, with almost complete occlusion of the vagina; the diagnosis can then be made by rectal examination only. The removal of the body is not always a simple matter; but it is an absolute necessity, since its retention might cause death from putrid peritonitis. The first step is the antiseptic douche; the second is to dilate the stricture; the third is to remove the foreign body. Occasionally it is necessary to divide the recto-vaginal septum, which should be followed, after the removal of the foreign body, by immediate reunion. The cavity left should be thoroughly disinfected and plugged with gauze.

W. J. SMYLY.

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THE MORBID CONDITIONS OF THE FEMALE GENITAL ORGANS RESULTING FROM PARTURITION

(Lacerations, Fistulas, Morbid Involution)

Many of the diseases to which women are liable arise from injury received in child-birth.

Two kinds of injury may occur: (1) The tissues may be mechanically damaged; (2) micro-organisms and toxins produced by them may get into the tissues. Either kind of injury may result in much after-suffering; often both injuries are combined.

In the pages which follow I shall describe the mechanical injuries which may occur in child-birth, and the effects of them which may persist after child-birth is over. The diseases to which these injuries, by permitting the access of micro-organisms, may indirectly give rise, are described in other sections of this *System*.

The mechanical injuries are of two kinds: (A) tearing, and (B) crushing. I shall first describe tearing; and I shall take first the part which is the first to be torn.

MECHANICAL INJURIES—A. TEARING.—I. **The Cervix Uteri.**—In some few labours the os uteri, solely by stretching, expands to a size large enough to let the child pass. But the force which is dilating the os increases as the size of the os increases; this force shortly before delivery becomes very great, so that the enlargement of the os is finished, in most cases, not by stretching, but by tearing. If the accoucheur add to the force by pulling with forceps before dilatation is complete, the tearing is generally greater than in deliveries left to nature. The tears, whether produced by unaided nature or by the forceps, are generally lateral. They may be confined to the vaginal portion, or they may extend up to the os internum (see Fig. 168), down into the vagina, and outwards into the cellular tissue. They are often multiple, running in a stellate fashion from the os uteri; but if so, the lateral tears are usually the deepest. Big rents are said to be most frequent on the left side; but the preponderance is not great. Rents, great or small, are so frequent that their presence is a valuable presumptive evidence of antecedent child-birth.

Some persons think that these tears entail very important after-effects. It has been said, but without any evidence, that cancer of the cervix might be prevented by sewing up these tears. The first practical question is whether anything can be done to prevent such effects.

Should tears of the cervix be sewn up at once?—Some writers have advised accoucheurs to sew up all tears of the cervix at once. This is difficult and troublesome. Moreover, as Freund has pointed out, these tears are irregular, and in the condition of parts after delivery it is difficult to follow them up. The accoucheur may think he has sewn up the whole of a tear when there remains a gap above or outside his line of suture which he has not perceived; and his stitches, by preventing free exit of discharge from such a spot, may favour retention and decomposition of discharge, and thus produce blood-poisoning. In sewing up a deep rent it is possible to include the ureter in the stitches. During the involution of the uterus these tears heal to a large extent; I therefore agree with Freund, that the suture of lacerations of the cervix immediately after delivery is only desirable when required to stop bleeding.

The results of cervical lacerations.—Each tear of the cervix is an open wound. If during lying-in the genital organs are kept clean, and the lochia flow away properly, the wounds heal. The opposite surfaces of the tear may unite, and then no trace of it remains: but they seldom do, and the wound usually heals by granulation. Epithelium on one side develops from the mucous membrane of the vaginal surface of the cervix, on the other side from that of the cervical canal, and a fibrous scar is formed where they meet.

When the cervix surrounding the os externum has thus been made into two lips, with a gap between them, and the patient gets up, the intra-abdominal pressure drives the cervix uteri against the posterior vaginal wall. This pressure forces the lips of the cervix asunder, and eversion of the lower part of the cervical canal is the result. By this eversion, mucous membrane which should not be exposed to any friction or pressure is exposed to friction and pressure against the vagina. The effects of such friction and pressure are not the same in every case. In some, the part of the cervical canal exposed by eversion undergoes changes which make it like that of the vaginal portion; its columnar epithelium becomes changed into squamous, its rugæ becomes less prominent and may be effaced, and its colour becomes the same pale bluish pink as that of the vaginal portion. There is no inflammation of the cervix; its lips, although everted, are not thickened, and no symptoms arise. This change is more likely to happen if the involution of the uterus has gone on well.

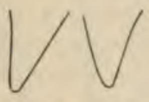

FIG. 166.—Profile on section of lacerated, but healthy, cervix uteri (diagrammatic).

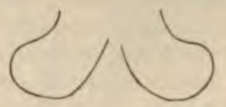

FIG. 167.—Profile on section of lacerated and inflamed cervix uteri (diagrammatic).

In other cases, and especially in those in which there is subinvolution, the friction and pressure produce and keep up chronic inflammation of the cervix. Its lips become not only everted, but swollen; instead of their profile (on section) being conical, as in Fig. 166, it becomes club-shaped, as in Fig. 167. Its surface often becomes the seat of the adenomatous growth known as "erosion"—which name was applied to it before its histological structure was known. The growth, as its name implies, is one of gland tissue. The orifices of these newly-formed glands often become blocked, the secretion is retained, and the gland becomes converted into a cyst containing a clear viscid fluid, a muco-purulent fluid, or pus. These cysts may remain after all other signs of adenomatous growth have disappeared.

The symptoms and treatment of the inflammation of the cervix thus produced or kept up by the eversion resulting from laceration are described in the section on "Inflammation of the Uterus" (p. 226).

II. The Vagina.—Considerable injuries to the vagina seldom occur during the spontaneous birth of a living child, or even when the delivery of such a child is skilfully helped with forceps; slight abrasions and shallow fissures, however, can be found after most first labours, if looked for, in the lower third of the vagina.

Conditions favouring injuries to the vagina.—But laceration of the vagina sometimes takes place even when the child is born without assistance. There are four conditions which make the vagina more than usually liable to be torn. These are (1) contraction of the vagina by fibrous tissue: either parametritic exudation which has become organised into fibrous tissue, or scar tissue left after operations for vaginal fistulæ, rupture of the perineum, or the removal of vaginal cysts. (2) In the older primiparæ the tissues stretch badly, and are therefore more likely to be torn. (3) Laceration of the vagina has been observed in cases of difficult labour with small pelves, and it has been inferred that the tearing has happened because the vagina was small as well as the pelvis; but in such cases there is more than usual compression of the vagina between the head and the pelvis; moreover, instrumental delivery is more often needed; these circumstances are to my mind a better explanation of the frequency of laceration of the vagina than a hypothetical smallness of the canal. (4) In some pelves the normal bony prominences are more pronounced than usual; among them the ischial spines. If this be the case, the vagina is especially liable to laceration where it is compressed between the fœtal head and these bony points. Tearing of the vagina in natural labour is apt to occur when the pains are very strong and the head very large, so that the stretching of the vagina is great and comparatively sudden.

Situation of vaginal tears.—The vagina is narrowest at its lower part, but it is here thicker and stronger on account of the muscles and fasciæ inserted into it. The median raphe of the vagina is its thickest part. The posterior wall of the vagina is longer than the anterior, and is more stretched during labour; for it forms the outside of the curve along which the fœtal head has to pass. Hence those tears that depend on rigidity of the tissues, or on large size and sudden expulsion of the head, are most often on the posterior wall and on one side, the side being that to which the face was turned during its passage through the pelvis (Fig. 168). The position of lacerations due to scar tissue, or to pressure upon prominent bony points, depends upon the situation of those structural peculiarities.

Effects of displacement of the vagina.—When the os uteri is fully dilated, and is drawn up over the head, the upper part of the vagina is pulled up. As the head is driven down, it presses the mucous membrane down before it. In these two ways the mucous membrane may be moved on the submucous tissue; it may either be pulled up or pushed down.

By such displacement of the vagina before the advancing head, the vagina is stretched from above downwards; and as tears by stretching are transverse to the line of greatest tension, tears running transversely to the long axis of the vagina and parallel to its orifice are thus produced. Tears of this kind are generally near the orifice: Duncan estimated their frequency in first labours at about 12 per cent. From this movement it follows that injuries of the vagina caused by pressure on bony points are not always exactly over these bony points, but sometimes above them, forming a sinus or pocket running downwards (Fig. 169). Another consequence is that in the displacement of the mucous membrane on the

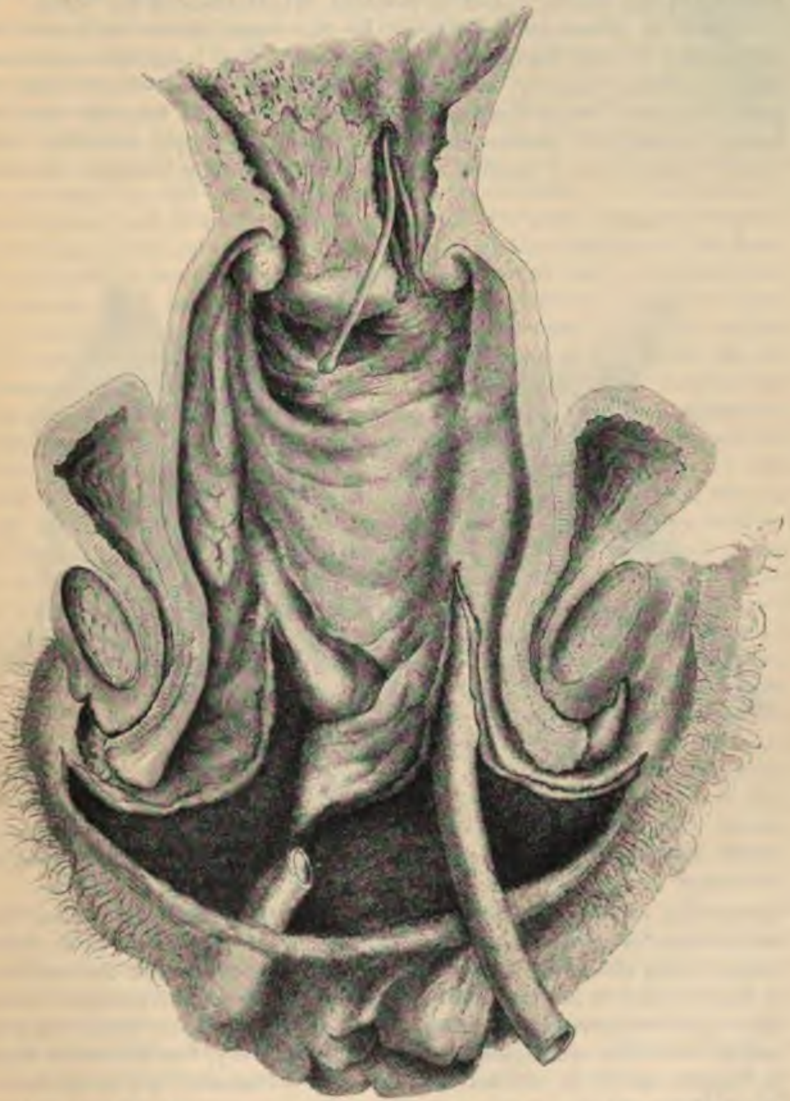

FIG. 168.—(After Freund.) Lacerations of cervix uteri and vagina. From nature. (The anterior part of the vagina, part of the bladder, and pubic bones have been removed, and a probe and drainage-tubes inserted in the lacerations.)

submucous tissue, vessels may be torn and blood effused in quantity varying from a few ecchymoses up to an amount sufficient to form the swelling of the labium known as *thrombus*, or *hæmatoma* of the vulva.

Effects of instrumental delivery.—In the ways above described the vagina may be torn during natural delivery. But lacerations are more often produced directly, either by instruments, or by sharp edges or points of bone. Such tears may be deep, and extend into the bladder, ureter, rectum, or peritoneum. As a rule they imply unskilful midwifery; either badly applied instruments, or pulling wrongly directed.

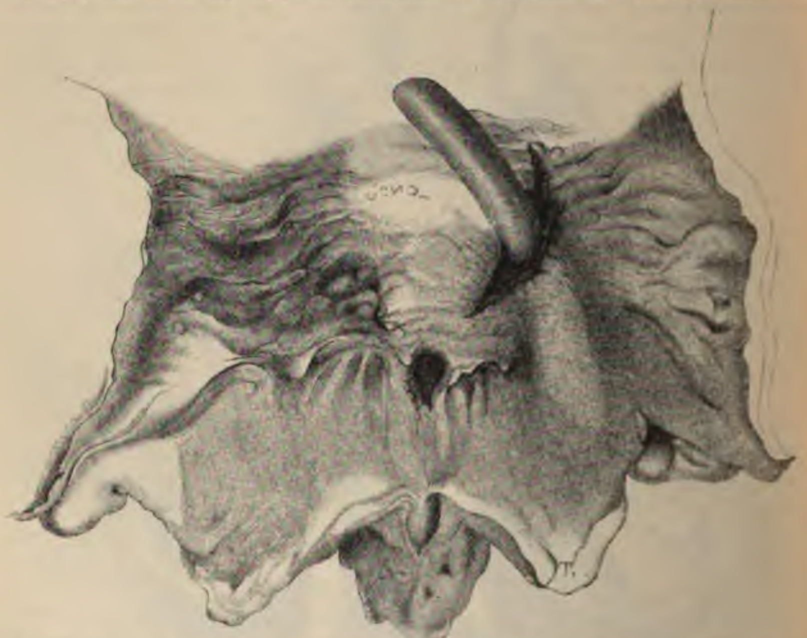

FIG. 169. (After Freund.) Laceration of vagina forming a "pocket." A drainage-tube has been placed in the "pocket." (From nature.)

But as the vagina is sometimes torn in natural delivery, it is clear that in the cases in which this is likely to happen, delivery in the most skilful manner with the most perfect instruments cannot prevent the accident. A medical man is not, therefore, necessarily deserving of censure because the vagina was torn during instrumental delivery. Injury to the vagina is not an inevitable accompaniment of forceps delivery, but it is more likely to happen, and to be extensive, if delivery is hastened by forceps than if it is left to nature.

How forceps delivery produces lacerations.—Forceps delivery adds to the risk of vaginal laceration in five ways. 1. The blades of the forceps increase by their thickness the measurement of the mass traversing the vagina; the vagina, therefore, is a little more stretched, though not much.

2. The forceps is used to hasten delivery; its use, therefore, generally implies that the vagina is less gradually stretched than when dilatation of the soft parts is left to the comparatively slow action of the natural forces. The rate of progress is an important factor in the production of vaginal lacerations. 3. Unless the forceps exactly follows every movement of the fœtal head, its blades cannot always lie flat to the head; if they do not, then one edge of each blade will be raised off the fœtal head. Although this projecting edge is not sharp, yet the vagina, where it is pressed against this edge, is very tense, and may be cut; this is the main factor in the production of forceps lacerations. 4. The curve of the forceps is of greater radius than that of the head; hence the vaginal stretching is not only increased at the poles of the diameter of the fœtal head in which the forceps blades lie, but is enforced over a larger surface. Moreover, as I have said, the head in forceps delivery is made to move on more quickly, and as the dilating agent advances down the vagina, that canal must either dilate or move on in front of it. From the increased volume and increased speed of the dilating body, it results that the displacement of the vaginal mucous membrane over the submucous tissues before the advancing mass, composed of the head in the grasp of the forceps, is more than that which is produced by the head alone. The bulging down of the vagina before the advancing forceps can be seen in any high forceps delivery. 5. When the head is delivered by artificial pulling, the normal mechanism is interfered with; for the accoucheur cannot so exactly acquaint himself with the relations of the head and the pelvis as to pull in the precise direction and at the precise moment which will adapt the head to the pelvis in the most advantageous manner. There is often, therefore, a greater diameter of distension at a given place than in the normal process, and in this way the probability of vaginal laceration is increased. The advocates of the axis traction forceps claim that it lessens the risk of laceration of the vagina. With this instrument the lifting of the edge of the forceps blade off the head, and the interference with the natural mechanism, are lessened; but I doubt if they are done away with. The other modes in which forceps delivery favours laceration of the vagina remain the same whatever the instrument used.

Results of vaginal laceration.—Tears of the vagina are important; firstly, because they may cause hæmorrhage after delivery. The treatment of such bleeding is a part of practical midwifery, and does not come within the scope of this article. Secondly, they make the patient more liable to puerperal illness; for every wound opens a gate for the direct entry of septic organisms. The presence of suppurating wounds in the vagina increases the amount of the lochial discharge, and as wounds of the vagina may form pockets (3), in which lochial discharge may be retained and decompose, any active microbes present in the passages will multiply in them. These microbes may produce in the retained discharge a chemical poison which produces fever (sapræmia); or in successive generations they may acquire fresh power, and produce septicæmia, phlebitis and pyæmia, or pelvic cellulitis.

Tears of the vagina may extend beyond the mucous membrane, and injure the fasciæ and muscles which form the pelvic floor. These structures may indeed be injured without laceration of the mucous membrane; or tears of the mucous membrane may heal, but the injury to the surrounding parts be imperfectly repaired. These injuries to the muscles and fasciæ will be next described.

III. Injuries to the muscles and fasciæ of the pelvic floor.—The fact that prolapse of the uterus is commoner in women who have had children than in virgins shows that this condition is favoured by child-bearing. It is certainly not due to lacerations of the vaginal mucous membrane, or of the perineum; for complete rupture of the perineum may exist unrepaired for years without prolapse. It is therefore a reasonable inference that child-bearing favours prolapse by causing injury to those structures in the pelvic floor which are the main supports of the uterus, namely, the pelvic fasciæ and the levator ani muscle. But our knowledge of these injuries has not advanced beyond opinion. I know of no dissection made to show the existence or the precise extent of such tears.

Schatz has described subcutaneous or rather submucous laceration of the muscles forming the pelvic floor (chiefly the levator ani) as occurring during labour. He inferred it by feeling, through the vagina, gaps between the muscular bundles, gaps which he assumed to be produced by the tearing through of other bundles which ought to have filled these spaces; but he has not verified this opinion by dissection. I have felt gaps between the muscular bundles such as Schatz describes, but I have failed to trace a subsequent tendency to prolapse in the patients in whom I detected them. Skene has also described subcutaneous or submucous laceration of the pelvic floor during delivery (presumably independently, for he does not refer to Schatz's paper, which was published about a year previously). He describes not only rupture, but fatty degeneration, atrophy, and paralysis of the torn muscular fibres; but he does not say that he has verified either the ruptures or the degeneration by dissection. He also describes a change in the position of the anus as a result of injury to the pelvic floor; but it does not appear from his paper that he has compared the state of the parts before child-bearing, in any particular case, with the state after it; without such a comparison it is not possible to be certain that what are described as changes due to injury in child-birth are changes at all. Kelly has described "relaxation" as "the most important of all injuries of the perineum and pelvic floor." His description of the injuries is based upon that of Schatz, but contains nothing to indicate that he has verified them by dissection. He says that as a result of these injuries the anal cleft is no longer a sharp, deep furrow, but is flat and shallow; and the anus is set farther back and more exposed. But without knowing in the individual cases what was the condition of the parts before child-birth, it is not possible to be sure that the peculiarities mentioned are really the result of injury. The depth of the anal cleft depends principally on the fatness of the buttocks, and the distance of the anus from the coccyx and pubes respectively is different in different women.

For the reasons given, I believe that the fasciæ and muscles of the pelvic floor are often injured in child-birth; and that such injury is the main cause of uterine displacements, notwithstanding that the fact has not yet been demonstrated by the exhibition of specimens. These displacements are described elsewhere in this *System* (*vide* p. 177).

IV. Rupture of the perineum.—Lacerations of the vagina are found out only by those who look for them. Injuries to the pelvic floor are a matter of inference, although their existence is almost certain. Rupture of the perineum has been known as long as midwifery has been practised.

Tears of the vaginal orifice.—As the fœtal head emerges, its stress falls first upon the vaginal, and then upon the vulvar orifice; the vaginal orifice is marked by the hymen; the posterior part of the vulvar orifice, which is the part made tense, is the fourchette. The orifice of the vagina is in the nullipara its narrowest part; consequently, if any part of the vagina be torn, it is this. The vaginal orifice is always torn in first labours. Such tears are often multiple and stellate, radiating from the vaginal orifice; but whatever other lacerations may take place, there is always one in the mesial line. Tears are more numerous on the left than on the right side. If the child is small, the tear may be limited to the vaginal orifice and not involve the fourchette.

Tears of the perineum.—Cases such as those just mentioned are the exception. In many first labours (according to Duncan in 60 per cent) the tear extends upwards through the mucous membrane of the vagina, backwards through the skin of the perineum, and through the tissues between them. This is rupture of the perineum. If the tear does not extend through the sphincter ani it is called "incomplete rupture." During delivery the perineum is stretched both from side to side and from above downwards. The tension of its anterior edge is from side to side, and therefore rupture here occurs in a line perpendicular to that of greatest tension; that is, from before backwards. When the anterior edge is stretched till it can stretch no more it gives way, and the tear extends until by it the opening has been made large enough for the head to pass. The extent of the tear depends upon four factors. (i.) The elasticity of the tissues; that is, the power of the tissue elements to rearrange themselves so that the part may elongate. Tears of the perineum are especially met with in elderly primiparæ, whose tissues are less elastic than those of the young: the difference dependent upon age is not great, but it exists. We know not what the structural peculiarities are which make one perineum more capable of stretching than another. (ii.) The length and situation of the perineum. The length of the perineum (5) in the nullipara varies from five-eighths of an inch to two inches. The situation of the fourchette varies from as much as two inches behind the lower border of the symphysis pubis, to close up to the symphysis. It is obvious that if the perineum be short and its anterior edge far back, less stretching will be required to let the child pass than if the perineum be long and its anterior edge far forward. (iii.) The amount of stretching required, or, in other words, the size of the child. The birth of large children is oftener accompanied with rupture of the perineum than the birth of small children. Of children of average size the head is the largest part, and therefore that which tears the perineum. But in children of excessive size the trunk is larger in proportion to the head than in those of average size; therefore with very large children the perineum is liable to be torn, or a small tear to be enlarged, during the passage of the shoulders. (iv.) The suddenness of the stretching. The more gradual the stretching of the perineum the less likely is rupture to occur. Rupture of the perineum is especially apt to happen in labours completed by very strong uterine action (such, for instance, as is provoked by ergot), in which case the child is propelled quickly through the genital canal; the same occurs in labours assisted with forceps if the child be too rapidly pulled through the vulvar orifice. It is not, however, a necessary consequence of forceps delivery; for this can be so managed as to give the perineum time to stretch. In labour protracted by weak pains, but ended naturally, rupture of the perineum seldom occurs.

Central rupture of the perineum.—The common kind of rupture of the perineum is that which has been described above—a tear beginning at the tense anterior edge, and extending backwards. The tear generally begins in the middle line, but, owing to the vagina being thicker in the median raphe, an extensive tear seldom keeps the middle line.

There are less common ways in which rupture occurs. One way is called central rupture (Fig. 170): in this form the tear begins in the posterior wall of the vagina, above the orifice; then as the head is forced on, it presses into the tear in the vagina, widens it, presses asunder the muscular and fibrous structures of the perineal body, bulges down the skin in the middle of the perineum, and finally tears it. The tear, thus begun in the middle of the perineum, may extend forwards to the fourchette and backwards to the anus—central rupture thus becoming complete rupture. Such I believe to be the common mode of production of central rupture of the perineum. But a tear of the vagina and cellular tissue of the perineum may not involve the skin of the perineum; the skin of the perineum may be centrally split without injury to the mucous membrane of the vagina; and the cellular tissue of the perineum may be torn without tear of either vaginal mucous membrane or perineal skin. The formation of a central perforation may begin in any one of these ways, the order of tearing being not always the same. Children have been born through central rupture of the perineum without injury to either anus or fourchette (10); although I think (with Madame Lachapelle and Matthews Duncan) that it is more common for delivery to take place through the vaginal orifice even in the presence of a central rupture.

Rupture from above downwards.—There is a still rarer mode of rupture of the perineum which I have once seen. The recto-vaginal septum was first torn through, and then this tear extended downwards through the perineum. After the head had been delivered the hand protruded through the anus, and then the shoulder came down, tearing the perineum from above downwards. Such a rupture must, of course, always be complete. This mode of rupture has also been reported by Baudry.

Healing of perineal rupture.—If left untreated, incomplete rupture of the perineum usually unites through part only of its extent, by the union of granulations on opposite sides; so that the perineum remains shorter than it was before. Complete rupture of the perineum occasionally heals without treatment; but this is an exceptional event.

Results of rupture of perineum.—Complete rupture of the perineum deprives the patient of the power of retaining fæces in the rectum. If a few fibres of the sphincter ani remain intact, so that its power is not destroyed, but only weakened, the patient may be able to retain scybala, but unable to retain fluid fæces.

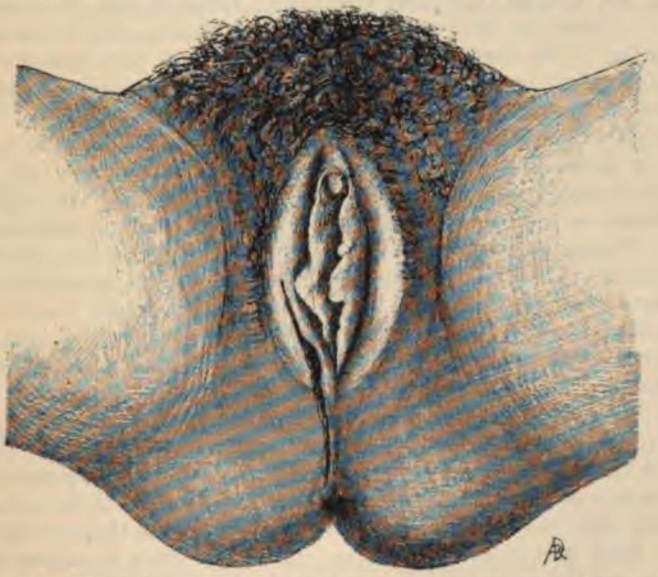

FIG. 170.—(After Ribemont-Dessaignes and Lepage.) Central rupture of perineum. (From nature.)

Incomplete rupture of the perineum enlarges the vaginal orifice. The consciousness of being "more open" is sometimes disagreeable to the patient. If the patient suffer from descent of the uterus or vagina, for which the support of a pessary is desirable, the shortening of the perineum may make it difficult or impossible to get a vaginal pessary retained.

Neither complete nor incomplete rupture of perineum can cause prolapse of the uterus. I have seen a patient whose perineum had been ruptured twenty years before, in her first and only confinement, who had suffered since from inability to retain her fæces, yet she had not the slightest prolapse. But in the way above described rupture of the perineum much affects the success of the mechanical treatment of the prolapse. Central rupture of the perineum may heal incompletely, leaving a fistulous channel between the vagina and the perineum. Madame Lachapelle thought such fistula to be its usual consequence. That such fistulas are seldom now seen is a gratifying illustration of the progress of obstetric surgery.

Treatment.—There is only one treatment of rupture of the perineum, and that is a plastic operation. The description of the operation is not within the scope of this article (*vide* p. 842).

I come now to describe the injuries produced by crushing.

MECHANICAL INJURIES—B. CRUSHING.—**Vaginal Fistulas.**—Vaginal fistulas are among the most distressing consequences of mismanaged labour. There are three ways in which such fistulas may be formed: (1) By tearing. The tears in the vagina which have been described in the foregoing pages may be so deep and extensive as to open the bladder or the rectum, and then, if healing be imperfect, a fistula is left. This is the usual way in which recto-vaginal fistula is formed, but it is a rare mode of production of vesical fistulas. (2) By perforation, that is, by a sharp instrument or point of bone being thrust through the vagina into the bladder or rectum. This is a rare mode of origin of fistulas of any kind. Fistulas formed either by tearing or perforation have this feature in common, that the symptoms they cause appear immediately after delivery. (3) By sloughing. Nineteen out of twenty vesical fistulas are produced in this way. When so produced, symptoms do not appear immediately after delivery, but are postponed till after the separation of the slough. The sloughing comes of continuous compression of soft tissues between the fœtal head and the pelvic bones: such compression takes place when the membranes have ruptured, the amniotic fluid has drained away, the uterus has passed into a state of tonic contraction, and there is such a disproportion between the fœtal head and the pelvic brim or cavity that the head cannot enter the one or pass through the other. If the head cannot enter the brim, the uterine force is exerted in compressing the soft parts nipped between the head and the most prominent points of the pelvic brim. In the ordinary form of contracted pelvis the most prominent points are the sacral promontory and the pubic symphysis; the pressure effects are therefore greatest opposite those points. If the pressure be so great as to kill the nipped tissues, they slough. This sloughing is produced, not by the magnitude of the pressure, but by its long continuance without intermission. The after-effects of the sloughing depend upon the situation of the damage.

Crushing of tissues opposite sacral promontory.—The vaginal wall, or the cervix uteri, may slough where there has been compression between the head and the sacral promontory, and such sloughing may open the pouch of Douglas. If the parts are preserved from septic infection the slough is separated, and Douglas's pouch is closed by adhesive inflammation. Such adhesions may alter the position of the uterus, and some physicians think that such changes in the position of the uterus produce ulterior harmful effects. Information upon this point will be found in the article upon "Displacements of the Uterus" (p. 177).

Crushing of tissues opposite the symphysis pubis.—Sloughing in this situation is more important than in any other, because here it destroys the integrity of the urinary passages. The tissues which suffer most are those nearest the head, that is, the posterior wall of the urinary canal; and therefore the result of such sloughing is incontinence of urine.

Situations of urinary fistulas.—The place at which the sloughing takes place depends upon the extent to which the os uteri had been dilated and pulled up over the head at the time pressure became continuous (Fig. 171). Sometimes, although very rarely, the membranes rupture early, and the os uteri dilates slowly, so that the amniotic fluid has drained off, and pressure has become continuous before the bladder has been pulled up out of the pelvis. In this case the slough may involve the cervix uteri and the ureter, a uretero-cervical fistula being formed. (These are often spoken of as "uretero-uterine fistulas," but the sloughing affects the cervix, not the body of the uterus.) One or both ureters may, in consequence of sloughing, come to open into the fistula. It must be admitted as possible that the tissues killed by pressure may comprise the ureters, and not the bladder; but the most probable explanation of such cases is that the slough involved cervix, ureters, and bladder wall; and that, while the urine was flowing away through the cervix, the gap in the bladder healed by granulation. No uretero-cervical fistula has yet been dissected after death. If there is a persistent hole in the bladder as well as the destruction of part of the ureters and cervix, the condition is called vesico-cervical (or incorrectly vesico-uterine) fistula. The destruction of

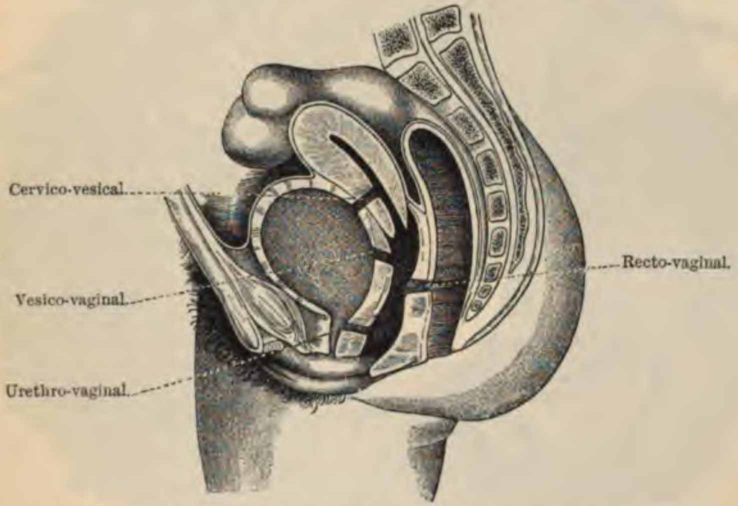

FIG. 171.—(After de Sinéty.) Diagram showing different kinds of fistula.

tissue may involve a large part of the cervix uteri and the vagina; and this state is called vesico-cervico-vaginal (or vesico-utero-vaginal) fistula. Fistulas involving the cervix uteri are rare; according to Neugebauer they form about 8 per cent of the vesical fistulas which follow delivery: fistulas involving the ureter are still rarer; they are rare, because pressure during delivery seldom becomes continuous until after the cervix uteri has been pulled up out of the pelvic cavity. When at this latter stage of the labour pressure becomes continuous, the bladder wall is killed at the part where it is in relation with the vagina, and a vesico-vaginal fistula is the injury which results.

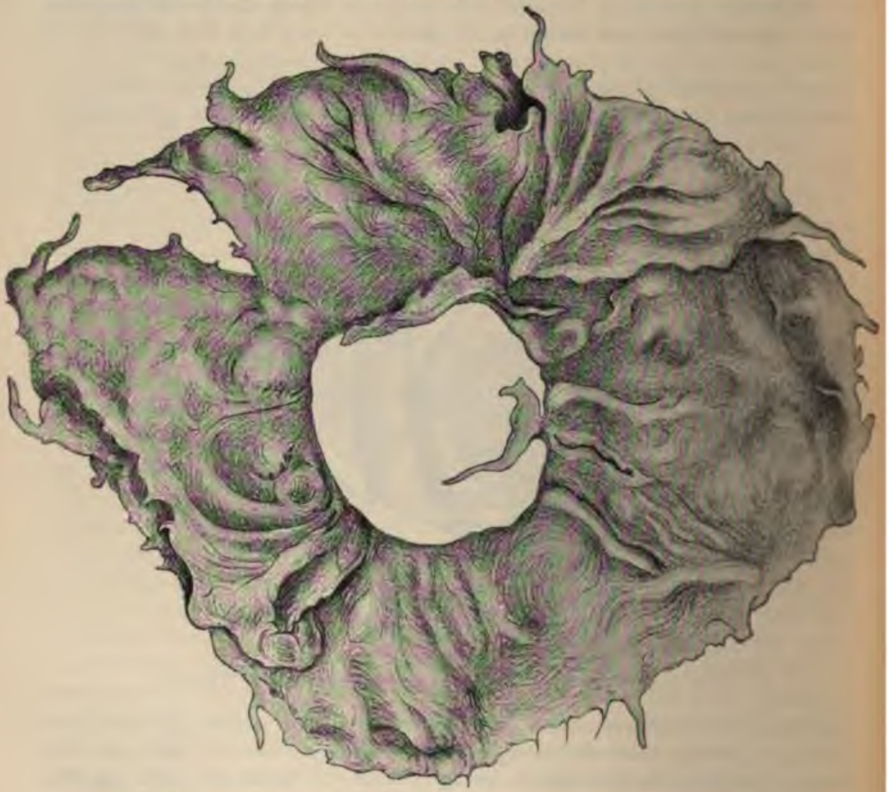

FIG. 172.—(After Martin.) Annular sloughing of cervix uteri. (From nature.) Upper surface.

It is possible that during labour the relation of parts may alter, or be interfered with, so that after part of the cervix, ureters, and bladder have been so compressed as to kill the tissues, the cervix may be pulled up, and continuous pressure come to be exerted on the bladder; thus two fistulas, a vesico-cervical and a vesico-vaginal, are formed. The more probable explanation of the coexistence of two fistulas is that the sloughing at first produced one large gap, but that across this gap a bridge of tissue has subsequently united. Cervical fistulas, according to Neugebauer, are more common in multiparæ than in primiparæ.

Annular Sloughing.—In cases in which the pelvis is contracted in all its dimensions, or, being normal in shape and size, the child's head is too large, the head may enter the pelvic cavity and become impacted there; that is to say, stuck fast, unable either to advance or to recede. If this happen, a ring of soft tissue where the head is in contact with the pelvis will be crushed all round. If the impaction take place before the dilatation of the os uteri is complete, the cervix uteri may have its vascular supply cut off by the crushing of a ring of tissue above it, and may consequently slough. This sloughing may affect only a ring of cervical tissue, and, if so limited, the ill effects do not outlast the puerperium (Figs. 172 and 173). But the killing of tissue by pressure may affect more than the cervix; it may involve also the upper part of the vagina and the base of the bladder. When healing has taken place, so far as it may after separation of such a slough, the vagina is found converted into a short funnel ending in

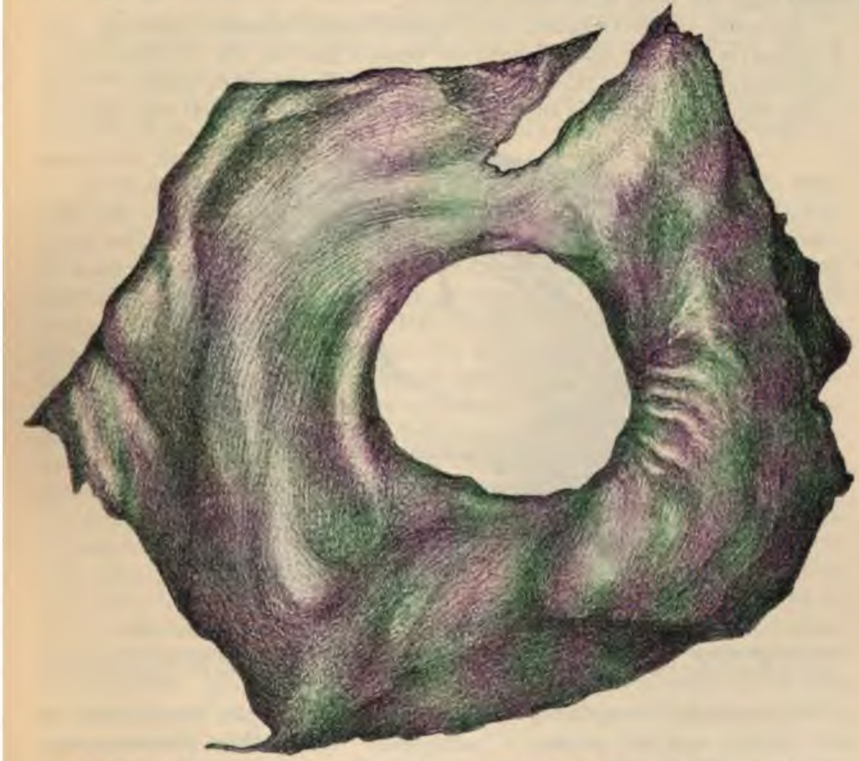

FIG. 173.—(After Martin.) Annular sloughing of cervix uteri. (From nature.) Lower surface.

scar tissue bounding a hole not large enough to admit the finger. I have recorded a case in which such sloughing (5) took place in a woman who was not pregnant: in that case I was not able to find out its cause. The slough is preserved in the London Hospital Museum (Fig. 174) (2123). I have seen a case in which sloughing took place after delivery, and the resulting condition was exactly the same as in the case above referred to; therefore, although the slough was not preserved, I do not doubt that the same parts were involved.

Symptoms.—The symptom of a vesical fistula, wherever situated and of whatever size, is incontinence of urine; that is, the patient's urine continually runs away through the vagina. The only exception to this is that when the fistula is small the pressure of the vaginal wall against it will sometimes temporarily close it while there is not much urine in the bladder, and the patient is recumbent. Hence these patients sometimes say that they can retain the urine for a time while lying down. The presence of a fistula is suggested, and may almost be affirmed by the urinous smell of the patient's clothing, before its discovery on examination. Incontinence of urine is not the same thing as irritation of the bladder, that is, frequent micturition; although in both the patient may describe her trouble as inability to retain urine. When there is merely irritation the patient can generally empty the bladder often enough to prevent her clothing from being more than occasionally wetted; but when there is incontinence this is impossible, and unless special provision be made the clothes become saturated.

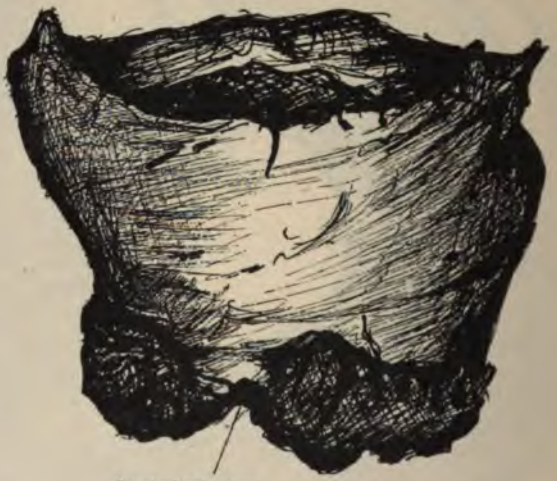

FIG. 174.—Slough in one mass of cervix uteri, upper part of vagina, and base of bladder. From a specimen in the London Hospital Museum. No. 2123. (Natural size.) (Drawn by Dr. J. H. Sequeira.)

History.—When a fistula has been formed in the usual way—that is, by sloughing of the parts from pressure—there is no incontinence until the slough has at some part separated. Hence the history will be that the patient had a long labour, but no incontinence of urine till from five to ten days afterwards (which is the usual time for the separation of the slough), or even later; and that then the urine began to run away involuntarily. If the fistula was produced by tearing or by perforation the incontinence of urine will date from delivery.

Diagnosis.—This can only be finally made by physical examination. Put the patient on her side, and expose the cervix and vagina with a duck-bill speculum; if there be a vaginal fistula the opening will be seen. Vaginal fistulas are often large; and then the mucous membrane of the opposite vesical wall often bulges through the fistula, forming a rugous swelling of deeper red and more velvety feel than the vaginal wall. Cervical fistulas are generally small; a cervical fistula big enough to admit the finger is exceptional.

If when the cervix and vagina are exposed a fistula cannot be seen, and yet there is no doubt that urine continually escapes by the vagina, put a catheter in the urethra and inject milk into the bladder. If there be a very small vaginal fistula, the white, conspicuous jet of milk escaping through it will mark its place. If the fistula be cervical, the milk will come back through the cervix uteri. If the fistula be uretero-cervical on one side, the history will be that the urine flows continually away by the vagina, while yet some urine is passed naturally; and when milk is injected into the bladder none will flow into the vagina. A cervical fistula involving both ureters is characterised by the flow of all the urine through a vagina which, on examination by injection of milk, shows no passage from the bladder to the vagina.

Usual concomitants.—With a fistulous opening into the bladder there is generally more or less severe cystitis, so that the urine is ammoniacal and ropy. Injury severe enough to cause sloughing of the bladder wall often leads to sloughing at other parts of the genital canal, and to pelvic inflammation; hence there is often fixation of the parts by parametritic exudation and by contraction of the vagina by scar tissue at other places. The irritation of the urine causes inflammation of the skin of the labia and thighs; and the mucous membrane and skin are often encrusted with earthy salts.

Relation to operative delivery.—When inquiry is made as to the labour after which a fistula has formed, it is found in most cases that some abnormal condition was present; and in many that operative delivery was required. Complications are frequent in such labours, because the disproportion which leads to continuous pressure also leads to disturbance of the mechanism of labour. There is no special complication other than disproportion, which produces sloughing and fistula as its consequence. The public are apt to think that the fistula was produced by the operative delivery, and it is true that in a few cases fistula is thus produced. In the great majority of cases, however—those in which the fistula is produced by sloughing—the fault lay, not in the interference with natural delivery, but in the undue postponement of operative delivery. It is hardly necessary to point out, however, that delay in giving aid is not always the fault of the medical attendant.

Treatment.—The curative treatment of a urinary fistula is its closure by a plastic operation. The description of these operations is beyond the scope of this article. [*Vide* art. "Plastic Gynæcological Operations," p. 811.]

The palliative treatment consists in the constant use of some appliance to receive the urine. While the patient is up, the choice lies between a urinal and absorbent pads frequently changed. The latter is the least disagreeable. Wood wool is the best absorbent material. The pads must be thicker than is required for the menstrual discharge, and must be changed often. If the patient be so situated that she must go for hours without the opportunity of changing the pads, she must wear a urinal—an appliance which consists essentially of a trough to receive the urine, whence it is conducted by a narrow tube to a bag. There are practically only two kinds: one in which the trough is made rigid, so that it keeps its shape, though its pressure may be irksome; the other (known as the French model) in which the trough is made of thin flexible india-rubber: this is less uncomfortable. At night discomfort is reduced to a minimum if the patient sleep on what is known as a "fracture bed" (that is, one with an opening in the middle for a pan), and be provided with plenty of absorbent material.

It is best to postpone operation until at least two months after delivery, and this for two reasons: firstly, the parts become less vascular and the tissues firmer after involution is complete, both of which changes are conducive to success in the operation; secondly, a vesical fistula, either cervical or vaginal, may spontaneously close. This is more likely to happen in the case of a cervical fistula, because such fistulas are small; but I have known a vaginal fistula, big enough to admit several fingers, to close completely without operation.

Recto-vaginal fistula, that is, an opening between the rectum and the vagina, is seldom produced by sloughing; because at the pelvic brim, the place where the tissues are most often nipped and made to slough, the rectum is at the side of the sacral promontory, and therefore out of the way of pressure. Such a fistula is generally the result of incomplete union of a bad rupture of the perineum—the lower part of the rent heals, the upper does not. These fistulas are seldom large.

A recto-vaginal fistula permits the involuntary escape of fæces and flatus from the rectum into the vagina. They are curable by a plastic operation, and in no other way.

MORBID INVOLUTION

Subinvolution means that the involution of the uterus after delivery has not been complete. To give a proper account of this, it is necessary first to describe briefly the normal process of involution.

The involution of the uterus.—On the day after delivery the uterus weighs from a pound and a half to two pounds and a half; and its fundus reaches as high as the umbilicus. Its return during the lying-in period nearly to the dimensions it had before pregnancy, is called "the involution of the uterus." Generally by the twelfth day after delivery the fundus uteri is no longer above the pelvic brim. Two weeks after delivery the uterus weighs about half a pound; and three weeks after delivery from four to six ounces. Involution is in most cases complete at the end of two months, sometimes at the end of a month; but sometimes it takes as long as three months.

How involution is effected.—We have no exact knowledge of the changes which take place in the peritoneal covering of the uterus. It becomes smaller, and the wrinkles present in it after delivery are smoothed away; this is all we know. It used to be stated that the muscular fibres of the pregnant uterus undergo fatty degeneration during the lying-in period and are thus removed, new ones being formed in their stead. The alleged fatty degeneration rests upon observations by Kölliker, supported by those of Luschka, Sänger, and Mayor; but it has been denied by Robin. The opinion that the old muscular fibres are destroyed and new ones developed, was originated by Kilian in 1849. His statements were based on very few observations: most of them were on the uteri of women who had died from disease, and were made after decomposition had begun; moreover, at the time they were made histology was in its infancy. The subject has been more recently studied by Dr. T. A. Helme, with the advantage of modern histological methods. He observed the process in the rabbit, and examined many specimens immediately after death, and at all stages of the process of involution. His results far outweigh the few and imperfect observations quoted in support of the old account. Helme finds no fatty degeneration. There is atrophy, that is, diminution in volume of the muscular fibres. There is not, as in a pathological atrophy, degeneration of the muscular fibres and increase of connective tissue, but a shrinking of muscle and connective tissue alike—a physiological retrogression. The change is probably chemical, a sort of peptonisation which makes the contents of the muscle cells more soluble, so that they can pass into the lymph stream; but there is no fatty change. The atrophy goes on simultaneously and equally at all parts of the uterus alike; no groups of degenerated cells are found amidst healthy tissues. Helme has noticed two stages in the process: during the first thirty-six hours the muscular fibres, which at the end of pregnancy are remarkably translucent, become cloudy and rapidly diminish in volume; then a more gradual shrinking follows. Helme finds no evidence of a destruction of old fibres, or of a formation of new ones. The only change seems to be that large fibres become small. Broers has investigated the subject in the same way as Helme, and finds fatty degeneration. Helme tells me he thinks that the granules which Broers takes for fat globules are not such: in support of his opinion he points out that Broers found them in blood corpuscles, a place where fat globules would hardly be expected, and in the uterus during labour.

Observations are also discrepant as regards the changes in the connective tissue. Fatty degeneration, atrophy, development of new connective tissue, have each been described. Helme finds that the connective tissue at first becomes granular, and then gradually diminishes and disappears.

During the last few days of pregnancy and the first few days of involution giant cells with many nuclei are to be seen: they are formed by the coalescence of single cells which are probably leucocytes. These giant cells are not seen after the sixth day of involution. Their function is probably to eat up the waste material lying about them—granules from connective tissue or matter in solution from muscle cells.

Structural changes take place also in the vessels. At the beginning of involution the veins are compressed by the contraction of the muscular bundles between which they lie; some of them become pervious again; in others, the endothelium comes to present a hyaline and granular appearance, and the vessel is gradually obliterated and disappears. In some of the veins there is a proliferation of the intima, so that the vessel wall becomes permanently thickened. In some of the arteries there is a hyaline and granular appearance of the coats; some become obliterated, but in the larger ones there is a true proliferative endarteritis, growth taking place both from the endothelium and from the sub-endothelial connective tissue. At the end of involution the connective tissue around the arteries is increased in quantity, the arterial muscular wall is greatly hypertrophied, and the inner wall considerably thickened. On section the arteries project beyond the surrounding surface, and present thick, yellowish white walls, more opaque than the tissues around. This state of the arteries was described by Sir J. Williams in 1882 (15). He holds that it affords "the strongest presumptive evidence of parity" that we possess.

In an ideal case involution should go on till the uterus is reduced to the same size as it was before pregnancy; this, however, seldom occurs. It is so common for involution to be not quite complete that in text-books of anatomy it is stated that the parous uterus is normally larger than the virgin uterus. When involution is thus incomplete, the condition of the uterus is called "subinvolution." In a few cases the involution goes on to such a degree that the uterus becomes smaller than it was before pregnancy. This is called "super-involution" or "puerperal atrophy of the uterus."

The morbid anatomy of subinvolution.—We know of no constant difference, except in size, between uteri which a few months after delivery still remain large, and those which have returned to the ordinary size of the unimpregnated uterus. General enlargement of the uterus with pelvic pain and other symptoms is known as "chronic metritis," and some writers have described subinvolution and chronic metritis as identical.[1] General enlargement of the uterus persisting long after delivery was described by Klebs under the name of "diffuse hyperplasia of the uterine parenchyma." He says that in some cases hypertrophy of the muscular fibres is present; in others, hypertrophy of the connective tissue bundles. The more the latter are developed the firmer the tissue. He says that this hypertrophy has been regarded as a result of chronic inflammation, and that in many cases inflammatory changes in the mucous membrane are unquestionably present; in many others, however, there is no clinical proof of inflammation having been present, the condition having developed itself without any symptoms [*vide* sect. on Fibrous Hyperplasia in Prof. Adami's art. on "Inflammation" in the *System of Medicine*, vol. i., and also Dr. Mott's art. in same volume]. Both inflammatory and non-inflammatory forms have in common the enlargement of the uterus and increase in its blood-supply. Klob described chronic enlargement of the uterus as being due to a diffuse growth of connective tissue. He said that the uterus is at first congested and turgid, the connective tissue being immature; but that the longer the disease lasts the denser the fibrous tissue becomes, compressing and perhaps obliterating the vessels, and making the uterine tissue paler and harder. At the beginning of the process, according to Klob, the muscular fibres are hypertrophied; but later they are lost in the hypertrophy of the connective tissue. The uterus when so enlarged has all its diameters increased, but especially the antero-posterior measurement of the uterine body. The cervix is thickened. The uterine cavity is longer and broader, but its anterior and posterior walls are still almost in contact. Klob holds that the pathological change is not a result of inflammation, but a growth of connective tissue. Klob does not say how far his conclusions are based on the writings of others, and how far on specimens examined by himself; nor does he say how many specimens he has examined, or from what women obtained. Without some knowledge of the age, the time intervening since the last pregnancy, the cause of death, and the associated morbid conditions in the pelvis, it is impossible to decide how far the changes described by Klob are such as naturally occur in healthy women as they grow older, or how far they are morbid.

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[1] The relation of subinvolution to metritis has been already discussed in a previous article (p. 231).—T. C. A.; T. W. E.

The causes of subinvolution.[1]—For perfect involution of the uterus to take place, it is necessary that during the lying-in period the patient should be healthy and the uterus contracted. The contractions of the uterus, by intermittently compressing the vessels, mechanically help the circulation both of blood and lymph through the organ. When the uterine contractions are imperfect, the more languid movement of the blood helps to make involution slow and incomplete. Therefore, after post-partum hæmorrhage—an accident which implies imperfect uterine contraction—subinvolution is apt to appear. Uterine contraction is especially imperfect when a bit of placenta or membrane is retained. The presence of what (in the lying-in period) is a foreign body in the uterus, not only interferes with uterine contractility, but mechanically prevents the shrinking of the organ. When fever arises all the bodily functions are badly performed, and the natural metabolism is altered; the uterus, like other tissues, then suffers, and its involution is retarded. This effect is especially marked when the cause of the fever is inflammation in the pelvis; for then the uterus not only suffers, in common with the rest of the body, from the febrile disturbance of nutrition, but the local inflammatory disturbance affects its own circulation. Hence the most marked cases of subinvolution are those associated with pelvic inflammation. Again, when women have many children, involution does not go on so fast, or take place so perfectly, as after their earlier labours.

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[1] For an analysis of what has been done on this subject and original observations, see References (16) and (11).

Subinvolution has been attributed to certain other causes which must therefore be mentioned:—(*a*) "General debility": this is so vague a term that it may include almost anything, and its effect can neither be proved nor disproved. (*b*) Parturition late in life: the effect of multiparity has been mentioned, and women who have had many children are generally elderly; but apart from multiparity, there is no evidence that the completeness of involution at all depends upon the patient's age. (*c*) Premature delivery: there is no evidence that after premature labours free from complication subinvolution is more frequent than after labour at term. Premature labour, however, is often induced for or by conditions—such as placenta prævia or constitutional disease—which lead to fever, or to imperfect contraction of the uterus; for these reasons, and not because delivery was premature, subinvolution may be more frequent after premature deliveries. (*d*) Laceration of the perineum: when there is a large wound of the genital passage the patient is more likely to become febrile than when the mucous membrane is intact; for this reason subinvolution is more frequent when the perineum is badly torn than when it is not torn; but the event is due to the fever, not to the rent in the perineum. (*e*) Lactation: some authors have stated that nursing favours involution, others that it hinders it; no facts have been brought forward in support of either assertion; nor do we know the effect of lactation on involution. (*f*) Lacerations of the cervix uteri: these have no influence on involution. They are so high up that in a well-managed confinement pathogenic microbes do not get access to them, and thus do not get the opportunity of causing fever. (*g*) Plural pregnancy: as the uterus is here bigger than usual, involution may be slower; but I know of no proof that it is so. (*h*) Other alleged causes: phthisis, diabetes, Bright's disease, syphilis, chronic suppuration, pneumonia, bronchitis, emphysema, heart disease, rheumatism, mental disturbance, chorea, eclampsia, bad sanitation, retroversion of the uterus, have all been said to hinder involution; but I have not found a particle of evidence to prove this effect of any one of them. They may or they may not cause subinvolution; we have no knowledge on the subject.

Effects of subinvolution.—Subinvolution in itself produces no disturbance of health. The uterus is often found large, but otherwise normal, in women who have had many children, and are quite well, but in whom examination was made because some disease was suspected.

A tissue that is in any way degenerated is more vulnerable under adverse influences than one which is healthy. Emphysematous lungs are more liable to bronchitis than healthy ones. A woman who has often suffered from the œdema common in pregnancy, is more likely to get her feet swollen from fatigue than one whose feet have never been œdematous. A uterus not well involuted is more liable to disturbances of its circulation, and to the morbid changes resulting therefrom, than a healthy uterus.

Subinvolution of the Vagina.—During pregnancy the vagina develops as well as the uterus; its vessels increase in number and size, it becomes larger, and its wall is thicker and softer. These changes obviously fit it for dilatation during child-birth. After delivery it undergoes involution; it becomes less vascular, its capacity less, its mucous membrane firmer and thinner. So far as I know, the minute anatomy of these changes has not yet been studied. In women who have had many children the involution of the vagina is often incomplete; the canal remains larger, its mucous membrane thicker, its rugæ larger. This subinvolution renders it more liable to catarrh, and women who have had children, especially those in whom the vagina is large and relaxed, are therefore more subject to leucorrhœa than virgins.

Treatment of subinvolution. A. *Preventive.*—In the management of child-bed, subinvolution is to be prevented (*a*) by taking care that no part of the placenta or the membranes is left behind in the uterus; (*b*) by the daily administration of ergot for three or four weeks after delivery. This drug has no effect upon normal involution; if, therefore, it is certain that everything is taking a normal course, the drug is unnecessary. But when any adverse condition prevents proper contraction of the uterus, ergot will hasten involution by making the uterus contract.[1] (*c*) By not allowing the patient to get about too soon. (*d*) I think, though I cannot adduce evidence in support of my opinion, that the use of astringent antiseptic douches during the lying-in period promotes involution of the vagina.

B. *Curative.*—When the puerperal state is over, and involution still incomplete, no treatment will make the uterus get smaller. One event, and one only, will alter the state of the uterus; that is, another pregnancy. If the patient become pregnant, the uterus in the succeeding puerperium, if no contrary cause again hinder involution, may fall to its natural size, or even below it.

Superinvolution of the Uterus.—What is superinvolution ? The word means that the uterine involution does not stop at the restoration of the uterus to its former size, but goes beyond this point, and leads to permanent diminution of the size of the organ and arrest of its functional activity. The ill-formed word "superinvolution" was introduced by Sir James Simpson; but the disease had been previously described under the better name by which it is still known in Germany, namely, "puerperal atrophy of the uterus." This term at once denotes its nature and its pathological alliance with atrophy of the uterus occurring in other circumstances.

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[1] In a paper by Dr. C. Owen Fowler and the author (*Obst. Trans.* vol. xxx.), evidence is published that in a series of unselected cases in which ergot was given, involution was less often delayed than in a series in which ergot was not given. The late Dr. Blanc of Lyons about the same time published a paper (see *Lancet*, 1892, v. 2, p. 1160), in which he compared two sets of cases, one with and one without ergot, and found that there was no difference in the rate of involution. But Dr. Blanc excluded all abnormal cases from his observations: his results are therefore in harmony with the view stated in the text.

Morbid anatomy.—German writers speak of "excentric" and "concentric" atrophy. Excentric atrophy means that the cavity of the uterus retains its natural dimensions, but that the wall of the organ is thinned, so that its external measurements are smaller. Concentric atrophy means that besides the wasting of its wall, the uterine cavity is diminished in length and breadth. It is reasonably believed that excentric atrophy is an early stage of concentric atrophy. It is easy to recognise concentric atrophy; but in the case of excentric atrophy it is difficult to say what degree of thinning of the uterine wall should be regarded as pathological, and very difficult to be certain of the existence of slight thinning. Hence statements about uterine atrophy, based on the supposition of excentric atrophy, are to receive only a provisional acceptation. It is said by German authors that some excentric atrophy takes place naturally during lactation; and that after weaning the uterus returns to its normal thickness. It is difficult to be sure of this, for we have no means, in the living subject, of measuring the thickness of the uterine wall; the fact of thinning rests only upon the impression of slightly diminished size gained by bimanual examination. Judging as well as I can in this imperfect way, I am disposed to think that the German observers are correct. In superinvolution this normal atrophy of lactation goes on to a higher degree, and is permanent.

When atrophy has advanced to the degree denoted by the word "superinvolution," the uterus is smaller in all its dimensions, and its wall is thinner; its mucous membrane is either absent or very thin; its muscular tissue is thinned, the fibres are closely packed, and among its fibres thrombosed and obliterated vessels are to be seen.

Etiology.—Certain puerperal diseases are followed by atrophy of the uterus. These are—(*a*) any puerperal illness leading to cachexia, that is, to wasting and anæmia; (*b*) suppuration of the ovaries leading to their destruction; (*c*) pelvic cellulitis leading to a fibrous induration which, constricting the vessels, cuts off part of the uterine blood-supply; (*d*) inflammation of such severity as to lead to sloughing of the inner part of the uterine wall—the so-called "endometritis dissicans." These diseases are rare, and recovery from them is rarer still. Puerperal atrophy of the uterus is also an unusual disease. Hence the relation between these rare conditions is supported by a very few observations. We know not what are the morbid changes in the ovaries, if any, upon which superinvolution depends.

There are also diseases which may lead to amenorrhœa and atrophy of the uterus, apart from the puerperal state; it seems a reasonable inference, therefore, that if they occurred in pregnancy they would lead to atrophy of the uterus during the puerperium: but their influence in this way is but a probability, not a fact verified by observation. Among them are phthisis, diabetes, Addison's disease, Graves' disease, myxœdema, insanity, emotional shock, paraplegia.

The foregoing are possible causes. The disease is so rare that no series of cases large enough to place the ordinary causation of superinvolution beyond dispute has yet been published. It is certain that superinvolution sometimes occurs in women in whom not one of the causes assigned for it (and enumerated above) has been present, and in whom examination reveals no other departure from the normal than that the uterus has undergone atrophy.

Symptoms.—The only invariable symptom is amenorrhœa. Sterility is probably a consequence, but as the essential condition for fertility in the female is not the state of the uterus, but the production of healthy ova (as shown by the occurrence of pregnancy in a rudimentary uterine cornu), it cannot be asserted that superinvolution directly or necessarily causes sterility. Superinvolution probably, indeed, depends on ovarian atrophy; but, as I have stated above, no morbid changes in the ovaries associated with superinvolution have yet been demonstrated.

As the climacteric is really produced by superinvolution, the changes and symptoms usual at the climacteric gradually supervene. The breasts waste, and the patients complain of the chills, flushes, and sweats which usually trouble women at the menopause. The only other symptoms that I have seen associated with superinvolution are frequent headaches and leucorrhœa. Sir James Simpson says that superinvolution is associated with "constitutional ill-health," "general debility," "depression and impaired activity of mind." This is no doubt true, but it is difficult to disentangle cause and effect, and to be sure whether superinvolution is the cause of ill-health, or the ill-health the cause of the superinvolution. In my judgment, the latter view is the true one; I do not think that any symptoms belong to superinvolution except amenorrhœa, sterility, and the usual climacteric disturbances.

Diagnosis of Superinvolution of the Uterus.—The diagnosis is suggested by the history, which is that of amenorrhœa dating from the birth of a child, and continuing although the patient has long ceased to suckle. It is made certain by finding out by physical examination the smallness of the uterus. This is done in three ways:—(*a*) By passing the sound. In this way the length of the uterine cavity can be accurately measured. A fallacy attends it, namely, that the sound may not have passed the whole length of the canal: therefore it needs to be supplemented by methods of determining the size as well as the length of the uterus. Of these the best is (*b*) bimanual examination, which means grasping the uterus between a finger in the vagina and a hand on the abdomen. Thus its size can be well estimated. If this cannot be done—either because from nervousness the patient keeps the abdominal walls very hard, or because she is very fat—then use method (*c*). Seize the cervix with a hook or volsella (the volsella gives the securer hold, but hurts the patient more), and pull it down towards the vulva. Then insert a finger into the rectum, and you will feel the whole length and breadth of the posterior surface of the uterus. The smallness of the uterus thus ascertained establishes the diagnosis of puerperal atrophy.

Treatment of superinvolution.—The only method of treatment which is unquestionably beneficial is the cure, if possible, of any condition of ill-health which may be the cause of the uterine atrophy. The modes of treating the different causes of anæmia and wasting are described in the medical sections of this *System*.

If the patient be florid, and the time at which menstruation should occur is marked by uncomfortable sensations, these symptoms may be relieved, and the uterus stimulated by the application of leeches to the cervix uteri. Cases of this kind are rare.

Electricity has been recommended. The only kind of electricity likely to be effective is the passage of a current through the organ between an electrode applied to the uterus and one on the abdominal wall; I know of no evidence, however, that such treatment has proved useful (see p. 803).

Stem pessaries, whether of glass, metal, or vulcanite, have been used. Sir James Simpson recommended a "galvanic stem," that is, an intra-uterine pessary made half of zinc and half of copper, the two halves lying side by side. When this is put into the uterus, the secretions of the part set up galvanic action between the zinc and the copper, and chloride of zinc is formed, which, being a caustic, inflames the mucous membrane with which it comes in contact. This is an injurious action. I know of no evidence that the galvanic stem does any good. But any intra-uterine stem, however unirritating the material, may produce peritonitis; and I know of no evidence that such stems will make a uterus which has undergone superinvolution again develop itself. If intra-uterine stems of any kind are to be employed, it should only be after explanation to the patient that the instrument is not likely to do good, and involves some risk to life. If the patient be rightly informed of the small prospect of benefit from local treatment, the dangers involved in it, and the unimportance of the effect of superinvolution upon health and duration of life, she will generally prefer to let it alone.

It is to my mind very doubtful whether any treatment will make a uterus, which has fallen into atrophy, again develop itself. In most cases in which the uterus is small because it never has developed, treatment is a failure; and the prospect when the uterus has normally developed, has been functionally active, and then has wasted prematurely, is far less hopeful.

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GYNÆCOLOGICAL THERAPEUTICS.

Success in the treatment of pelvic diseases depends not only upon a correct interpretation of the pelvic state, but also upon due regard being given to the condition of all the other organs. If there is a co-existing disease of another important viscus, it is useless to treat the pelvis alone. In estimating the importance of a pelvic abnormality it is necessary also to consider its effect upon the constitutional state of the individual; whether, in fact, it is a purely local lesion, or one likely to lead to grave constitutional disturbance. Frequently we have to deal with a "vicious circle," with local and constitutional states so interacting, that no real improvement is possible until both the general and local states receive their due share of attention.

Professor Clifford Allbutt has drawn attention to the influence of the nervous system on the symptomatology and treatment of Gynæcology. He says "the uterus has its maladies of local causation, its maladies of nervous causation, and its maladies of mixed causation, as other organs have." This element of neurosis it is which—whether cause, complication, or effect—tends to baffle the gynæcologist, and may prevent the symptomatic cure of a patient even when her pelvic organs have been restored to health. Instances of such complexity could be multiplied indefinitely, but would merely serve to emphasise the rule that general therapeutics are essential to the efficient treatment of almost all cases which, owing to the predominantly, or perhaps almost exclusively, pelvic character of the symptoms, come, correctly enough, under the term "gynæcological." Notwithstanding this, it is obviously impossible to do more than indicate briefly those therapeutic methods which are immediately pelvic in their application; and the more general methods must be rigidly omitted from consideration.

The subject of Gynæcological Therapeutics may be discussed under the following subdivisions:—

1. General Hygiene (Routine, Clothing, Diet, Baths, Exercise, etc.). 2. Rest (General, Local, Physiological). 3. Drugs (General and Special). 4. Balneology. 5. Local Therapeutical measures:—(i.) Heat and Cold: (*a*) External and (*b*) Internal application. (ii.) Medicinal agents: (*a*) to skin; (*b*) to vulva; (*c*) to vagina; (*d*) to uterus. 6. Blood-letting.

1. General Hygiene.—Dr. Robert Barnes's dictum remains true, "Occupation, physical and mental, is the great panacea; something to do is the great female cry."

There are two conditions of life which tend to aggravate, if not actually to produce pelvic disorders. The first is luxury, which allows a woman to spend her life in indolence and ease, leaving her mind a prey to morbid introspection, and her body prone to functional debilities, which tend in the one case to hysteria, in the other to neurasthenia. These, especially the latter, are much more frequently observed in the wealthier classes. The second condition of life which aggravates pelvic troubles is continuous over-exertion; this is chiefly found in women of the poorer classes, who have neither the opportunities of adequate rest, nor the change of environment after illness and parturition which their richer sisters can ensure. The mode of living ought then to be between these two extremes of indolence and over-exertion. The mind should be free from anxiety and strain, yet at the same time actively occupied with some healthy intellectual pursuit, which should prevent mental stagnation; the body should be stimulated by exercise suited to age, tastes, and circumstances; and, above all, the importance of functional regularity should be insisted upon.

The functions of menstruation and gestation are instances of rhythm in the movements of nature; the intermissions of the hollow viscera occur in cycles, which are approximately rhythmical; the more the woman is regular in these functional observances—in defæcation, micturition, the toilet of the skin, and exercise both mental and physical—the healthier she will be; and regularity of meals and sleep, both as regards time and duration, are no less important.

A daily cold bath or cold sponging heightens arterial tone, strengthens the heart's action, and is at the same time a powerful nerve stimulant. Occasional hot baths, as means of more perfect cleansing, are also essential, and should, except when taken at bedtime, be followed by cold sponging and rough towelling. During the menstrual period or in pregnancy the daily routine of baths and exercise may need some modification.

Clothing.—Women are influenced, for evil or for good, by the fashions of their generation. Clothes should be light and, as regards underclothing, loose in texture, made either of silk or, far better, of wool; or, if these cannot be worn, of loosely woven cotton, such as "cellular clothing."

They should not prevent the freedom of muscular and respiratory action, and should cover all parts uniformly, not leaving the genital organs unprotected, as in the usual arrangements of underclothing.

Exercise should never be excessive, and should be very moderate during menstruation. It should always be remembered that active exercise in moderation does more good than passive exercise; for when actively engaged all the muscles of the body are at "attention," not "off guard" and relaxed. Thus riding and driving are often better than being driven; and bicycling is better than the pedal sewing-machine, in which the leg muscles only are engaged. In cycling it is most important that the saddle should be wide enough to reach beyond the ischial tuberosities, which are wider apart in some persons than in others; otherwise the perineum becomes compressed, and the pelvic contents are unfavourably affected.

2. Rest.—*General; Local; Physiological.*

In no department of medicine is "rest" more essential, whether in prophylaxis or treatment, than in gynæcology. In the pelvis, as elsewhere, pain and disordered function are indications for rest.

Pelvic rest may be obtained in two ways: by the complete quiescence of the individual, or by a local quietude. The former is a method which the leisured class can usually adopt, but is one of which the poorer classes, unless in a hospital or "home," are unable to avail themselves. For this reason some surgeons have considered it right to treat hospital patients more radically than private ones, and would, for example, remove the uterine appendages for certain varieties of tubo-ovarian disease in a woman whose livelihood depends upon her activity; whereas a lady with leisure and means might undergo a prolonged course of rest and palliative treatment, with a view, if possible, to avoid this operation. Each case must be judged solely by its own needs viewed from the operator's standpoint.

Local rest, so useful in cases of uterine displacements with congestion, may be obtained by pessaries, which may permit the patient to take active exercise whilst the pelvic congestion, or the relaxed state of the uterine supports, are being simultaneously improved by constitutional or other local measures. Such "local" rest is particularly useful where the patient belongs to the working classes and cannot obtain "general" rest.

Whatever mechanical means be used, general or local, *physiological rest* can only be obtained by total abstinence from coitus. Sometimes, however, it is neither necessary nor desirable to enjoin sexual continence.

3. Drugs.—A wide and precise knowledge of the action and uses of drugs is essential in the treatment of disease, whether of one set of organs or another. This is especially true in gynæcology, where, as already indicated, so much depends upon the functional and organic integrity of the rest of the individual. By the stimulation of extra-pelvic secretory organs relief can be afforded to the intra-pelvic viscera. A few words, then, may be devoted to the principles which should guide us in the administration of the more general drugs.

Purgatives.—In no class of diseases are purgatives more useful. Constipation, by allowing the collection of scybala, may displace the pelvic viscera; or, by exerting pressure on the venous plexuses round the uterus and in the broad ligaments, may cause congestion and discomfort; or, again, acting constitutionally, may dispose to systemic and portal congestion, which injuriously affect the pelvic organs. In many cases of chronic pelvic disease a course of purgatives, such as sulphate of magnesium, cascara, or aloes, with a few doses of calomel, as occasion may require, will greatly relieve the patient.

In certain obscure cases of pseudo-ileus (Olshausen) Malcolm, Tait, Treves, and Lockwood have shown that a speedy evacuation of the bowel may prevent a life being lost from that form of blood-poisoning which is caused by the invasion of the system by bowel bacilli (bacillus coli communis), which, though always present and usually harmless, may under certain conditions become extremely active and virulent.

In many cases of acute pelvic inflammation it is far better to keep the bowels open daily by means of a simple mixture of cascara and sulphate of magnesium, than to keep the patient under the influence of opiates, and it is certainly better to do this than to alternate the use of opiates with strong purgatives every two or three days. In suitable cases enemata and rectal injections of glycerine are useful preliminaries or alternatives.

Tonics of all kinds may find a place in the treatment of pelvic disorders. Without going so far as Goodell, who says "one cardinal rule in the treatment of all uterine disorders is the internal administration of iron, and of other tonics, unless contra-indicated," there can be no doubt that iron is well borne in nearly all such cases. Iron should be given almost always with purgatives, otherwise it is often inert; and in such cases as anæmia and chlorosis, with scanty or absent catamenia, it may be combined with arsenic and freshly prepared acetate of ammonia. The perchloride of iron is far the most reliable drug in cases of a septic nature, as in sapræmia and septicæmia; and even in such cases as periuterine inflammations, where the septic element is not so obvious. It must be given in 15 to 30 drop doses every three to four hours. In cases of hypertrophic endometritis iron is sometimes ill borne unless the vascularity of the uterus be simultaneously lessened by ergot.

Permanganate of potassium, in doses of three grains (best combined with unguentum kaolin in the form of a pill), is very useful to increase the effect of iron; in cases of anæmia with amenorrhœa it should be given thrice daily for three days, upon the date when menstruation should appear.

Arsenic is valuable especially when leucorrhœa is present in anæmic girls, with a chronic catarrh of vagina or cervix; in them local treatment is not advisable until a fair trial of constitutional treatment has first been made.

Quinine, which has a special tonic action on the uterine muscle, is a useful adjunct; and in cases of debility or irritability of the involuntary muscles of the body it is usefully combined with strychnine, arsenic, and some sedative, such as belladonna, stramonium, or conium.

Sedatives must be given with great caution. States for which they may be indicated often recur; and the repeated administration of alcohol, opiates, etc., to women whose nervous system is overwrought or not under due control, especially at the climacteric, leads to continued use, or rather abuse of these agents. All such drugs should be given sparingly, and, if possible, so disguised or given in guarded prescriptions that patients may not readily obtain a continuous supply.

Special gynæcological drugs.—The most important of these are ergot; cannabis indica; hydrastis; chloride of ammonium; the bromides; a few coal tar derivatives, such as phenacetin; chloride of calcium; mercurial preparations, and some others, such as castor and apiol.

Ergot of rye is used for two main purposes, to encourage uterine contraction and to lessen uterine hæmorrhage. Its main action is on involuntary muscle fibres, causing a more prolonged contraction, and, according to some observers, leading to a true tonic contraction if given in continuous or sufficiently large doses. It causes also contraction of the arteries, and heightens arterial pressure. It may cause some intestinal or vesical irritation, and may then have to be given with belladonna to prevent such unpleasant sequences. Owing to its special action on the uterine muscle it is largely employed for the treatment of passive uterine hæmorrhage, or for that due to organic changes, as in uterine fibroids or fungous endometritis, where diminished vascularity tends to lessen growth. It is also given to promote indirectly the absorption of effete products, and at the same time, by encouraging contraction, to reduce uterine congestion; it may thus lessen the bulk of the uterus in cases of subinvolution, and in cases of fibroids may both starve the tumours and favour their extrusion. Ergot is apt to increase the pain of dysmenorrhœa, and may therefore have to be omitted just before and at the commencement of a menstrual period; with this occasional interruption, ergot may be given continuously for months, or even for years, without deranging the health. Every now and then, however, large doses will, by contraction of the arterioles, give the heart more to do than it is equal to, and it may have to be discontinued. Ergot, usually given by the mouth in the form of the extract or the liquid extract, may be administered hypodermically. Ergotinine, in doses of $\frac{1}{200}$th to $\frac{1}{50}$th of a grain, is also useful hypodermically, but though less irritating, it is less efficacious, and is also costly. In chronic hæmorrhages, or where given for long periods, ergot should be combined with acids and purgatives; but when given in severe acute hæmorrhage it should be combined with ammonia.

Hydrastis canadensis.—The best preparations are the tincture (dose ♏xx. to ♏lx.) and liquid extract (♏v. to ♏xv.). Though occasionally disappointing, this drug has a decided hæmostatic action, and if taken regularly will check chronic hæmorrhages not due to serious organic changes. The drug has also a sedative effect which ergot has not, and is useful therefore in menorrhagia where dysmenorrhœa is also present.

Cannabis indica is usually given in the form of the extract ($\frac{1}{4}$ to $\frac{1}{2}$ gr.).

It is extremely useful in cases of menorrhagia with pain, acting even better than hydrastis; where the pain of dysmenorrhœa is present, as in some cases of fibroids, it acts far better than ergot, although belladonna or bromide of potassium be added to the latter. Indian hemp varies greatly in strength, and should be ordered from one source; it must be remembered that it is one of those drugs which are apt to affect certain women peculiarly, and at first must be given cautiously in small doses. Vertigo is a frequent symptom of an overdose.

A large group of antispasmodics and sedatives may be used in the treatment of uterine colic, but it will suffice here to name the good effect which phenacetin, antipyrin, exalgine, and other coal tar derivatives, as well as apiol and castor, have in the relief of all sorts of pelvic pain, including the pain of dysmenorrhœa, cancer, and neuralgia. Nitroglycerine (gr. $\frac{1}{100}$th) also relieves pain, and is especially useful in the last stages of cancer of the uterus, where uræmic symptoms, such as headache, scanty urine, and nausea, may have supervened.

The bromides of potassium and ammonium allay the pain and general restlessness due to increased local tension, as for instance in cases where congestion of the ovary, or rapid growth of a fibroid, causes a painful distension of their enveloping capsules. They also tend to lessen hæmorrhage of a passive type, and are particularly useful when taken so as to anticipate menstruation where menorrhagia is associated with antemenstrual dysmenorrhœa, headache, nausea, or diarrhœa.

Chloride of ammonium has good effect in relieving pelvic congestion, probably by its action on the liver, and is therefore useful in all cases where the vascularity of the pelvis is increased, as in fibroids, subinvolution, chronic metritis, and simple congestion.

Chloride of calcium, in doses of 10 to 20 grains thrice daily for two or three days, is useful in some cases of menorrhagia, where ergot has failed; especially when a period is continued for some days beyond the week. It acts by encouraging coagulation of the blood.

Perchloride of mercury, and other preparations of that metal, assist in promoting absorption of long-standing inflammatory exudations, such as are found in the chronic metritis of subinvolution, or as persistent thickenings about the pelvic floor after pelvic inflammation.

4. Balneo-therapeutics.—Such a large subject as this can only be very briefly outlined, but the following remarks and table will not be out of place:—

There are certain health resorts and spas, at home and abroad, noted for springs of water which have been found useful in pelvic disorders. Some of the best are here tabled, but it must be remembered that it is often necessary to send a patient to a resort where the water is suitable rather to the constitutional diathesis than to the actual pelvic condition which may be a complication. Thus anæmic patients may be sent to Schwalbach, Nauheim, Levico, or Strathpeffer; gouty persons to Wiesbaden, Homburg, Bath, Harrogate, Kissingen, or elsewhere.

Sea-water, again, is a very good substitute where it is not possible to go to one of the following or other suitable resorts. Sea-water, when pure, is somewhat similar to Woodhall Spa water; it is rich in salines, bromine, and iodine; it is a powerful hepatic stimulant and purgative, and can be used advantageously internally as well as in the form of baths and douches, in some cases of portal and pelvic congestion.

The following are some of the baths which are especially useful in cases of chronic pelvic congestion, subinvolution, or fibroids, and serve to hasten complete recovery after acute inflammatory attacks, where exudation into the uterine or periuterine tissues has been well marked.

[For a more ample account of Balneology the reader is referred to the article by Sir Hermann Weber and Dr. Parkes Weber in *System of Medicine*, vol. i.]

TABLE OF BATHS AND HEALTH RESORTS FOR CHRONIC PELVIC DISORDERS

Names of Places and Altitude.	Season.	Character of Water.	Special Uses.
Bex, Switzerland, 1400 ft.	May to Sept.	Saline water, bromo-iodurated	Chronic pelvic exudations. Fibroids.
Carlsbad, Bohemia, 1214 ft.	May to Oct.	Alkaline saline. 120° F. to 170° F.	Chronic pelvic congestions. Gout.
Contrexeville, France, 1000 ft.	June to Sept.	Alkaline effervescing. 55° F.	Where gravel or urinary diseases complicate pelvic disorders.
Franzensbad, Bohemia, 1900 ft.	May to Sept.	Alkaline effervescing and ferruginous	Pelvic congestion with hæmorrhoids.
Kissingen, Bavaria, 600 ft.	June to Sept.	Cold Saline	Pelvic congestion with constipation.
Kreuznach, Germany, 350 ft.	May to Oct.	Bromo-iodurated and saline	Subinvolution. Chr. inflammation. Fibroids.
Marienbad, Austria-Hungary, 910 ft.	May to Sept.	Ferruginous mud-baths	Chronic exudations in cellular and peritoneal tissue.
Plombières, France, 1330 ft.	June to Sept.	Ferruginous. 66° F. to 143° F.	Chron. endometritis with anæmia.
Pyrmont, Germany, 440 ft.	May to Sept.	Effervescing, ferruginous, and saline	Chron. catarrh with anæmia.
Royat, France, 1480 ft.	June to Sept.	Alkaline, ferruginous, and arsenical. 45° F. to 95° F.	Pelvic congestion with gout.
Schwalbach, Germany, 955 ft.	May to Oct.	Ferruginous . .	Anæmia with chronic catarrh.
Salzbrunn, Bavaria, 2800 ft.	May to Oct.	Iodine springs. .	Chronic congestion.
Vittel, France, 1000 ft.	June to Sept.	Alkaline effervescing	Congestion with obstinate constipation.
Woodhall, Lincoln .	May to Oct.	Saline bromo-iodurated	Subinvolution. Chronic inflammation. Fibroids.

5. Local Therapeutical Measures.—i. *Heat and Cold.*—(*a*) *External Applications.*—Cold will excite reflex local contractions in both voluntary and involuntary muscle. In vigorous persons it increases the exhalation of carbonic acid. The effect of cold externally and suddenly applied is well seen when in its application to the abdomen to cause uterine contraction in post-partum hæmorrhage; or to the skin of the new-born child to excite diaphragmatic movement. The reflex effect of cold upon distant glandular organs is less well understood; but we know that cold locally applied temporarily checks glandular secretion—a check to be followed, in health, by a reactionary period of augmented secretion.

Heat, if moderate, is sedative; but if great, may excite muscular contraction as does extreme cold, producing this effect with less shock to the individual. Hot baths are mainly sedative, relaxing the skin and its glands, dilating peripheral vessels, and thus relieving congestions of internal viscera; they are useful, therefore, in congestive dysmenorrhœa, prolapsed ovary, and the like; and are very soothing to the flushings, the restlessness, and the irritability of the menopause. They also relieve muscular spasm and severe tension, and are therefore found serviceable in spasmodic dysmenorrhœa, and in cases of uterine, tubal, intestinal, hepatic, and renal colic.

Hot foot and sitz baths act somewhat similarly. In the bath, blood is drawn from the internal organs to the surface and to the legs; these baths are therefore useful in relieving pelvic congestion, and in cases where the catamenia have been suddenly arrested by "a chill." After the bath the menstrual flow is encouraged to continue. Mustard added to such baths increases these effects.

Poultices and fomentations, as regards both their utility and action, may be considered as local baths. If a sedative effect be required, belladonna or opium may be added to the fomentations; if a stimulating effect, turpentine may be added. If the local relaxation produced by a poultice be not wanted, a pad about a foot square can be made by sewing up some bran in quilted flannel. This can be put into the oven and applied dry, or may be kept hot by a Leiter's coil. By dipping this bran pad in very hot water it becomes a very light and ready poultice.

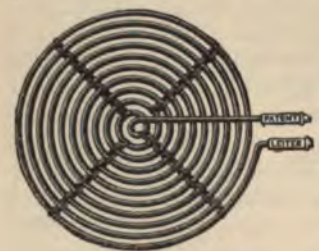

FIG. 175.—Leiter's coils.

Leiter's pliable metal coils (Fig. 175) have now taken the place formerly occupied by Chapman's spinal bags. Chapman showed that the heat or cold of these bags acted upon the spinal and ganglionic nerves going to the vessels. Thus ice-bags applied to the lower dorsal and lumbar regions in cases of arrested menstruation, by partially paralysing these vaso-motor nerves, and so causing dilatation of the pelvic vessels, encourage a freer pelvic circulation. Hot applications to the same regions are, by analogous action, useful in checking menorrhagia. Leiter's coils fulfil these objects admirably; and the water can be regulated and kept at any given temperature either by the addition of ice to the reservoir of water, or by a spirit-lamp under it; and cooling can be increased or lessened by the rate at which the continuous stream of water is allowed to pass through the tubes of the coil. The pliability of the coil allows it to be moulded to any part of the body, and if the tubes be made of aluminium their weight is trifling. For reducing temperature, a coil can be moulded to the back of the head, and iced water allowed to run through it. For rallying a patient suffering from shock, heated coils applied to the feet, on the chest, and under the arms answer admirably. If moist heat be required to imitate a poultice, cloths wrung out of warm water can be wrapped round the hot coil.

(*b*) *Internal Applications.*—Whilst in a bath, water can be made to enter the vagina by means of a grilled speculum (Fig. 176). The more usual means, however, is a douche apparatus. In all cases the flow into the vagina should be continuous—from an elevated supply of water, as from a suspended douche-can, or from an elevated syphon arrangement; not intermittent, as when a hand-ball enema is used. If cleansing alone be needed, two or three pints of water are sufficient; but for relief of local congestion irrigation is employed, and several pints are used for twenty to thirty minutes. The value of this procedure, however, is probably over-estimated. The vaginal nozzle should be of toughened glass and capable of being easily cleaned. The patient should lie flat on her back, with the pelvis raised on a bed-bath, or projecting over the edge of a couch. For the mere application of heat, all that is necessary beyond these points is that the temperature of the water should be properly regulated. In prolonged douching for relief of congestion, lukewarm water (95° F. to 105° F.) is indicated; but for arrest of hæmorrhage, or the production of muscular or vascular contraction, a temperature of 118° F. is required. Extremely cold water will also check hæmorrhage, though it will not promote coagulation of the blood; it is, however, obviously unsafe to employ it, as it may unduly check secretion, or prevent the menstrual flow from appearing if due. It is also much more trying to the general health of the patient, and water at so low a temperature is not readily obtainable.

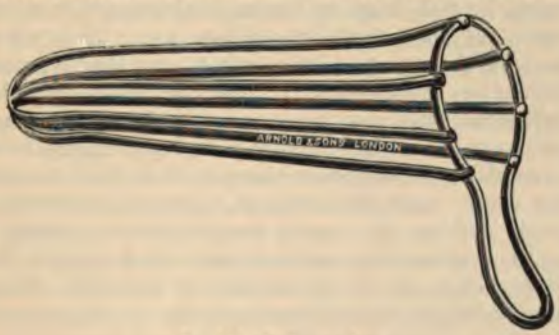

FIG. 176.—Bath speculum.

It must be remembered, however, that, in addition to the thermal properties of the vaginal douche, it also has a very well-marked mechanical action. This is best obtained by so elevating the douche-can as to make the continuous current of water somewhat forcible, and capable of ballooning the vagina. This action raises the uterus with its appendages and the other pelvic contents, empties engorged lymphatic vessels, glands, and distended veins, and gently stretches, and perhaps promotes the absorption of chronic inflammatory thickenings. This ballooning of the vagina can be increased by further elevation of the reservoir, or by the patient arresting the outflow of the water from the vagina by hand pressure on the vulvar orifice. By the addition of medicinal agents the douche can be rendered antiseptic, anodyne, astringent, or sedative. These further actions will be discussed later (p. 747).

(ii) *Medicinal agents applied to* (*a*) the skin; (*b*) the vulva; (*c*) the vagina; (*d*) the uterus.

(*a*) *The skin.*—Counter-irritation to the skin may be applied in a variety of ways, by such drugs as cantharides, mustard, turpentine, iodine liniment, croton oil, and others in ordinary use. They all lessen pain and tend to check the spread of inflammation, and also to promote absorption of inflammatory exudations. These results are probably brought about by influencing the vaso-motor nerves; by stimulating the skin, they lead also to its increased vascularity, and presumably to a relatively diminished vascularity of subjacent tissues. It is clear, too, that there is some distinct action upon the terminations of the nerve filaments from the spinal cord; and for this reason counter-irritants should be applied over the position where the nerve trunks, which supply the inflamed organs, send branches also to the surface of the skin. These areas, as Dr. Head has shown, are not necessarily at the site of greatest pain, but where the touch of a blunt point like a pin's head detects hyperæsthesia. It is found that these areas are supplied by the posterior root of the same nerve which also sends sensory nerves to the inflamed viscera. Thus the ovary, when inflamed, causes referred pain and cutaneous tenderness along the tenth dorsal area; the nerves going to inflamed Fallopian tubes are particularly associated with the eleventh and twelfth dorsal segments; so also are the nerves supplying the upper parts of the cervical canal and the internal os, the lower part of the cervix is related to the third and fourth sacral areas. Much valuable information on this subject may be found in Dr. Head's paper. It is difficult, of course, to estimate the curative effect of counter-irritants in those cases where rest in bed is a coincident factor in the treatment, but wherever possible these two means should be associated.

(*b*) *Applications to the vulva.*—Ointments, lotions, fomentations, and baths have each their appropriate usefulness. If the vulva alone be affected, especially in young children, baths form the best means for applying sedative or stimulating lotions.

(*c*) *Applications to the vagina.*—Medicaments may be applied to the vagina in many ways. Among them may be mentioned injections, douches, tampons of prepared wool or gauze, pessaries made up with cacao butter or gelatine; or applications, in the form of ointment, powder, or solution, may be made to definite areas of the vagina through a grilled or duckbill speculum.

Douches are a very convenient way of applying medicaments to the vagina. If used for antiseptic purposes, perchloride of mercury may be used in the proportion of 1 to 2000 or 4000; or if prolonged use be needed, carbolic acid (1 in 100), or tincture of iodine (ʒj. to pint), or borax or boric acid or izal may be substituted in the same proportion. Condy's fluid and sulphocarbolate of zinc are also useful. Creolin or lysol (1 in 200) are more suitable before a vaginal operation when it is important that the vagina should be soft and supple; most of the other antiseptics render it temporarily unyielding and contracted. For adequately sterilising the vagina more complete measures may be needed (see p. 780). Douches can be made sedative by means of the addition of liq. plumbi subacetatis (ʒij. to Oiij.), laudanum, or liq. opii sedativus (ʒj. to Oj.), chloral hydrate (gr. xx. to Oj.), borax or bicarbonate of soda (ʒij. to Oiij.), or Condy's fluid well diluted. Of astringent preparations, alum, sulphate of zinc, and tannin (in the proportion of half a drachm to the pint) are the best.

Medicated pessaries can be used for all purposes. Absorption is slow and imperfect through the vaginal mucous membrane, and at least double the usual dose of a drug should be thus administered. Only those drugs are thus used which are known to have a local effect. They are best combined with gelatine or with cacao butter, the latter being itself very soothing. The drugs most often used as sedatives are cocaine (gr. ij.), morphia (gr. j.), extract of belladonna (gr. ij.), henbane extract (gr. v.), hemlock extract (gr. v.) Astringent pessaries should be made up with cacao butter; alum and tannin are the agents most used.

If it is desired to relieve vaginal congestion, or to encourage secretion from the vagina, a pessary of glycerine (ʒiss.) combined with gelatine (ʒss.) is very efficacious. This agent has one of its most useful applications as a preliminary to rapid dilatation of the cervix, the nurse being directed to introduce the pessary up to the level of the cervix two hours before the operation. If desired, drugs may be added to these pessaries to make them antiseptic or sedative; and it is in this form that ichthyol, ♏iij. in each pessary, has its most useful sedative and absorbent application.

Tampons may be employed to plug the vagina, or lightly to pack it; but they are sometimes used as a convenient method of applying medicinal preparations to the walls of this passage. For this purpose gauze is easily applied saturated with various ingredients, such as carbolic acid, eucalyptus, iodoform, mercury salts, salicylic acid, sanitas, or thymol; or plain gauze previously dipped in the desired drug, such, for instance, as a 4 per cent solution of ichthyol and glycerine, may be used. Wool likewise, tied into convenient sizes, may be used, and can be obtained saturated with boracic acid or iodoform, or containing perchloride of mercury, eucalyptus, iodine, carbolic acid, or salicylic acid. Wool tampons can be made with astringents, such as alum or tannin, either mixed throughout the wool or rolled up inside it. Wool tampons steeped in glycerine may be used instead of glycerine pessaries, and are beneficial where the uterus needs support and depletion at the same time.

If it be desired to elevate the uterus, to keep the cervix forwards or backwards, or merely to rest the uterus after some operation in which it has been much drawn out of position, or in which adhesions to other viscera have been broken down, there is no need to pack the vagina very tightly; but this is very desirable where there is severe uterine hæmorrhage, though it is a much more certain hæmostatic procedure to plug the uterine cavity itself.

If the vagina is to be packed for hæmorrhage it should be disinfected, and the rectum and bladder should be emptied. The patient should lie in the Sims position, and a duckbill speculum should be passed. A piece of gauze should be inserted into the cervical canal, and the pouches around the cervix should be firmly packed with antiseptic gauze; a piece should also be laid over the cervix. Pieces of wool rolled up into cylinders about as large as the first thumb joint should be then passed up and pressed firmly against this roof of gauze, and the vagina completely filled; the strings attached to the wool tampons should be allowed to hang out of the vagina. As a rule, they should be left in for twenty-four hours, and it will generally be found that the hæmorrhage has been arrested by coagulation in the upper gauze layers.

Direct applications of drugs can be made through a speculum to any affected area of the vagina. Nitrate of silver up to a strength of gr. x. to ℥j., or an 8 per cent solution of sulphate of copper, is useful in some inflammatory states; pure carbolic acid, chromic acid, acid nitrate of mercury, bromine dissolved in spirits of wine (1 in 4), are all useful, with appropriate precautions in cases of new growth or malignant ulceration.

(*d*) *Applications to the uterus.*—Medicaments used for the vagina may also be employed for the vaginal portion, but more care is required for intra-uterine applications.

To apply substances to the endocervix it must be exposed by a speculum, such as Fergusson's (Fig. 39) or Neugebauer's (Fig. 177), in a good light; after its lining membrane is wiped free from mucus, the solution or powder should be applied on a probe, such as Playfair's, armed with cotton-wool. The substances most used are acidum carbolicum liquefactum, iodised phenol,[1] liquor iodi, iodine paint[2] or Churchill's solution of iodine,[3] liquor ferri perchloridi, and ichthyol (4 to 10 per cent solution). Another good method is to pour down a Fergusson's speculum a solution which can be encouraged to enter the cervical canal freely by means of an armed probe. One of the best solutions for this purpose is an 8 per cent solution of sulphate of copper. If there be much congestion, the cervix should be first punctured till it has assumed a light pink colour.

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[1] Iodine 1 part, and liquid carbolic acid 4 parts.

[2] Iodine, iodide of potassium, spirits of wine, and water, equal parts (Samaritan Free Hospital).

[3] Iodine, 78 grains; iodide of potassium, 90 grains; rectified spirits to one ounce.

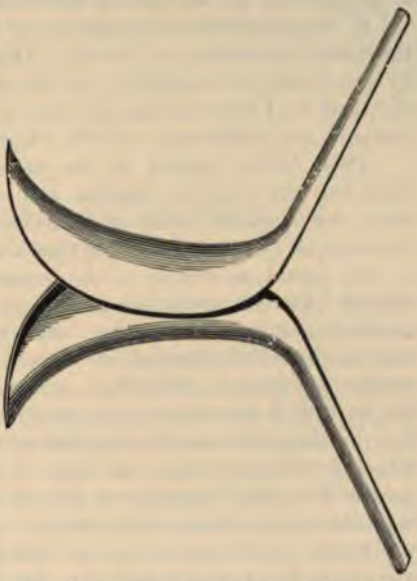

FIG. 177.—Diverging speculum (Neugebauer's).

Where the endometrium is extensively inflamed, or is the seat of adenomatous overgrowth, dilatation and curetting become necessary; but there are many milder inflammatory conditions of the endometrium in which a cure can be obtained by several careful applications of one or other of these or other drugs to the cavity of the uterus. They are best used through a Fergusson's speculum, and should be carried into the uterus on a Playfair's probe[1] suitably curved. The cervix should be exposed and cleansed, and a sound passed to ascertain the exact uterine curve. If this curve be acute, the cervix should be held and drawn down by a tenaculum (Fig. 178); and if the sound prove that any constriction exists, a few bougies should first be passed, as uterine colic is thereby prevented and good drainage facilitated. Except in rare cases, these measures should be taken when the patient is in bed and able to be at rest for some hours. After the application, it is a good plan to pass into the uterus, above the level of the os internum, a thin strip of gauze or lint, soaked in iodine and glycerine, to ensure a watery discharge and free drainage. It should be removed in twelve hours, and an antiseptic douche given.

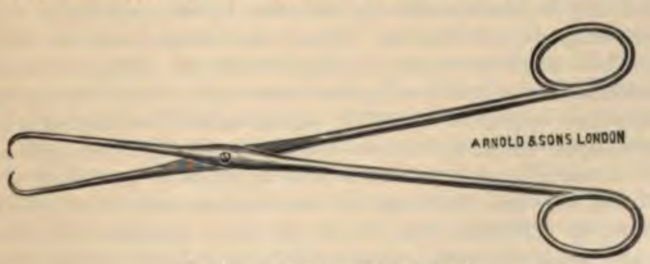

FIG. 178.—Uterine tenaculum (Sims').

Intra-uterine injections should never be used without security of free exit; and in any case no very irritating solution should be injected, lest sudden uterine contraction should occur. It must be remembered also that occasionally the Fallopian tubes remain patent as a result of disease, or as part of a general pelvic subinvolution.

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[1] The best variety of Playfair's probe has not a bulbous end, but tapers slightly, and the wool, though held sufficiently firmly not to come off when the probe is withdrawn, will come off readily enough afterwards without scissors. It should be made of aluminium.

6. **Blood-letting.**—Sometimes it is desirable to relieve congestion by the local abstraction of blood. This may be done by applying leeches, by puncturing, or scarifying; or the same result may be arrived at by the abstraction of blood-serum, as when blisters are applied, or when glycerine tampons are introduced into the vagina.

Thus *leeches applied to the perineum* relieve pelvic congestion by depleting the superior, median, and inferior hæmorrhoidal vessels coming from the common iliac, internal iliac, and pubic arteries respectively; between all of which there is free anastomosis. Relief is thus afforded to the portal as well as to the general system, as the superior hæmorrhoidal vein belongs to the portal, while the middle and inferior belong to the general venous system. Mr. Marmaduke Sheild has drawn attention to the relief afforded to vesical and pelvic congestion and irritation by the application of leeches or counter-irritation to the inside of the thighs. This he accounts for partly by vaso-motor influence, but mainly by the depletion of the capillaries fed by the pudic branches of the femoral, relieving thus the area of congestion by lowering the blood-pressure in the branches of the internal pudic from the internal iliac, with which they freely anastomose.

Leeches to the groin can be shown to act in a similar manner, and the signal relief thus afforded to swollen ovaries is probably produced by depleting the small twigs from the ovarian artery which pass along the round ligament to the inguinal canal, as well as, more indirectly, through the anastomoses between the superficial and deep epigastric vessels and deep-lying twigs from branches of the internal iliac vessels.

Blood may be abstracted from the cervix by the application of leeches, by puncturing, or scarification. Blood thus drawn relieves the whole pelvis. The cervix is mainly supplied from the uterine arteries; but these anastomose so freely with the ovarian and vesical arteries that the relief becomes very general. The vagina should be douched with some warm antiseptic solution, such as borax (℥ij. to Oiij.), the patient being in bed in a warm room. In cases of congestion of pathological origin, with marked blueness of the cervix, instantaneous relief is afforded by the abstraction, by puncture, even of two or three drachms—the cervix becoming and remaining pink; thus it becomes evident that the circulation, which was stagnant, is restored. Puncturing is done by exposing the cervix in a speculum, rendering the surface antiseptically clean, and then with a long-handled sharp-pointed knife gently stabbing the vaginal aspect of the cervix. These stabs should be very slight at first, so as to indicate the tendency to bleed; they may then be increased in depth and number till the loss is considered sufficient. Cross cuts (scarifying) may be employed instead of these punctures, or as an addition to them. The subsequent treatment is as for leech-bites. Such an abstraction of blood may be required once a week, for two or three times, the effect being continued by drugs, hot douches, and glycerine pessaries, with rest and diet according to circumstances. If much congestion be present in cases of endocervicitis or endometritis, a preliminary puncturing is advisable before applying remedies to the lining membrane.

AMAND ROUTH.

ANTISEPSIS AND ASEPSIS IN RELATION TO GYNÆCOLOGICAL SURGERY

THERE is no doubt that success in modern surgery is mainly secured by minute and painstaking preparation. Manual dexterity, deftness, and rapidity are of much less importance to the success of an operation than aseptic hands and sterile ligatures. Without proper preparation an abdominal operation may become, in many instances, a greater risk to the life or health of the patient than the disease from which it is designed to free her. Nevertheless, with due care and precaution, the opening of the peritoneal cavity of itself is practically devoid of surgical risks, and this has rendered possible the large number of abdominal operations now performed by election and not from necessity; operations, that is, performed for the relief of pain or deformity, not for the saving of life. The responsibility devolving upon surgeons who perform such operations as these is no light one, and it carries with it the undertaking on their part to employ, with conscientious thoroughness, the best means at their disposal to ensure the safety of the patient from all risks of infection. Safety can only be ensured by careful, elaborate, and often laborious preparation; and the aim of this article is to set forth in some detail the present state of our knowledge of aseptic and antiseptic principles in their application to gynæcological operations.

The Organisms which produce Wound Infection.—Although under normal conditions micro-organisms are absolutely ubiquitous, the greater number of them are non-pathogenic in character. Of those which are pathogenic, *i.e.* capable of producing disease, many require a specially prepared medium for their development, and probably exert their influence only upon living tissues which, owing to injury or malnutrition, have fallen below the standard of health. Others, again, are capable of attacking living tissues in a condition of undisturbed vitality, and of producing local death at the point of entrance, or of invading the whole body and permeating it with the deleterious products of their chemical reaction upon the tissues, so as to produce a fatal issue. The latter class contains the organisms most dreaded by surgeons, viz. the pyogenic organisms. For while certain organisms belonging to the former class, *e.g.* the tubercle bacillus, sometimes infect wounds, the results of this form of infection do not compare in gravity with those which arise from infection with pyogenic cocci. It is, therefore, against a comparatively restricted class of organisms that the warfare of surgery is to be waged.

The pyogenic organisms comprise the following species :—

1. Staphylococcus pyogenes aureus.
2. Staphylococcus pyogenes albus.
3. Staphylococcus epidermidis albus (Welch) (a variety of staphylococcus pyogenes which is habitually found in human skin).
4. Streptococcus pyogenes.
5. Bacillus proteus vulgaris (Hauser)
6. Bacillus saprogenis (Rosenbach) } Organisms of putrefaction.
7. Bacillus pyogenes fœtidus
8. Bacillus septicus.
9. Bacillus coli communis.
10. Bacillus pyocyaneus (produces a greenish or bluish coloured pus).
11. Bacillus aerogenes encapsulatus.
12. Micrococcus tetragenus.

Of these the streptococci and staphylococci are most to be feared, both for their virulence and for their very widespread distribution in crowded centres of population. The organisms of putrefaction can be readily attacked, as their sources of origin are well known and their distribution comparatively limited. Next to the pyogenic cocci the bacillus coli communis is the most important in relation to pelvic surgery. Its normal habitat is the intestine, but it has been detected by Welch in wounds. It is of course well known as a cause of peritonitis after operations upon the intestines and other parts of the alimentary canal, although its part in producing surgical disasters can by no means be said to be fully explained. After certain severe injuries to the intestines, such as gangrene and strangulation, it is capable of entering the peritoneal cavity and setting up fatal general peritonitis—a remarkable instance of auto-infection. There is a good deal of evidence, further, that many injuries to the bowel much slighter in degree than those named may occasion peritoneal infection by this organism. After death it is known that the bacillus coli soon passes from the intestine into the fluids and closed cavities of the body, and it is probable that the same occurs as the result of loss of vitality of the peritoneal membrane. To its activity are also due, in all probability, a certain number of cases of peritonitis following operation upon abdominal organs unconnected with the alimentary canal; it is frequently found in inflammatory conditions of the urinary passages, and occasionally in puerperal septicæmia. It may thus be the cause of auto-infection under a variety of circumstances about which there is still much to be learned. Bacillus septicus is the cause of acute, spreading, traumatic gangrene; it is an anærobic organism which in its development produces certain gases, and thus causes emphysema in the affected tissues.

In addition to the list given above, it is obvious that if such organisms as the bacillus anthracis, the bacillus tetani, or the bacillus Löffler (diphtheria) obtain access to operation wounds, the result may be that the patient will be attacked by the virulent systemic diseases of which these organisms are the specific cause. Actinomyces and the organisms of glanders and tubercle may cause localised suppuration in wounds. Although not causes of "wound infection" as strictly interpreted, their exclusion from wounds is a matter of great importance. Another organism which is of the greatest importance to gynæcological surgeons is the diplococcus gonorrhœæ. The ravages produced by this organism in the female pelvic organs are sometimes of the greatest severity, and one of the difficulties to be faced by the surgeon who removes a gonorrhœal pyosalpinx is to prevent the organism from infecting the general peritoneal cavity as a consequence of his manipulations. When introduced into wounds it has probably little effect in producing local suppuration, for it is difficult to grow this organism except upon mucous membranes.

It does not come within the scope of this article to describe the microscopic characteristics of the above micro-organisms, or their artificial culture and differentiation from other forms. For these details a text-book of bacteriology must be consulted. But an attempt will now be made to indicate briefly the sources from which the more important forms are believed to arise, and the channels through which they may obtain access to the field of operation in which the surgeon is working.

The common organisms of *suppuration*—streptococci and staphylococci—of course, are produced in countless numbers wherever pus is formed, *i.e.* in small skin pustules, in boils, in ulcers, as well as in the larger collections which we call abscesses. From these centres of production they are distributed by desiccation of discharges, and subsequent disintegration by air currents; in clothing, bedding, dressings, and upon the skin and clothes of all who have been in contact with the patient. It is therefore not surprising that these pyogenic cocci are frequently present in the air of hospital wards and operating theatres, and can frequently be grown from these sources, proving that they are present in a living state. Their presence is, no doubt, inevitable in all buildings where cases of suppuration, or of such infectious diseases as erysipelas and diphtheria are gathered together. The fresher air of open spaces, and especially of the open country, is practically free from organisms of this kind. Fortunately micrococci, when dried, soon perish, differing notably in this respect from the spore-bearing bacteria, and the greater number of those present in dust, for instance, are dead, and no longer capable of doing mischief. It is probably only when they are kept alive by being carried upon moist particles that they can produce infection. This fact has led Prof. Watson Cheyne to say that dust is comparatively harmless from the surgical standpoint, and this statement can no doubt be accepted without hesitation. Germs of all kinds are found in much fewer numbers in high altitudes than in low-lying districts, and the air brought in by sea-breezes is practically germ-free; but these facts can seldom be taken advantage of in the arrangements for surgical operations, which will always be most required in crowded centres of population where the atmospheric conditions are most favourable to the occurrence of wound-infection. Pyogenic cocci are sometimes found in tap-water; and the water of shallow wells is frequently contaminated with many varieties of pathogenic organisms. Pyogenic cocci also occur in the mouths and throats of healthy persons, and may be grown from the saliva. The possible sources of infection by pyogenic organisms may therefore be said to be three in number: *first*, everything that has been in actual contact with cases of suppuration and infectious disease, or that has been exposed to the air of rooms in which such cases are lying; *secondly*, air; *thirdly*, water. Of these three the first is, of course, in all respects the most important, and that against which the most careful precautions should be taken. The methods of sterilisation at the disposal of the surgeon are, as we shall presently see, by no means absolutely reliable, and it is better, as far as possible, to avoid the sources from which these potent mischief-makers come.

The sources from which the organisms of *putrefaction* are derived are sufficiently clear; they need not be insisted upon further than to point out the absolute incompatibility between modern surgery and the work of the dissecting-room and the dead-house.

The *bacillus septicus* is very frequently found in the mud of roads—country roads as well as town thoroughfares. The *bacillus coli communis* is also usually present in the mud of roads and the soil of fields and gardens, its source being, no doubt, the various kinds of animal excreta; and by the desiccating and locomotive actions of air-currents it may obviously become widely distributed, and find its way in dust, or upon items of the surgeon's armamentarium, into the field of operation itself. We do not as yet know the difference in the results produced by this organism when its source is heterogenous from those produced by auto-infection.

We are thus in a position to trace with approximate certainty the chief organisms responsible for surgical infection, their centres of origin, and the channels through which they are capable of reaching the field of operation, and of entering wounds should the opportunity of so doing be allowed them. It is the object of antiseptic and aseptic methods to keep the field of operation free from these organisms; as they cannot be totally exterminated, the most we can do is to destroy them in selected areas. But under natural conditions pyogenic organisms are never found alone; they are accompanied by other varieties, many of which are probably harmless, but of this we can have no certainty. The only plan which offers an approach to security therefore is to attempt the destruction of all organisms of whatever kind within the field of operation. The test of absolute sterility, *i.e.* freedom from living organisms of all kinds, is the only criterion which, in the present state of our knowledge, we can apply to surgical methods. For one thing, there is no rapid, simple, and reliable test of the absence of pyogenic cocci except that of total sterility.

and even if we were in a position to demonstrate the absence of the whole class of wound-infecting organisms, we could not, in the meantime, be sure that such a condition would fulfil all the conditions requisite for safety in surgical work. The aim of the operator must therefore be the high one of operating always in the absence of all living forms of micro-organisms. The criterion of a safe instrument or surgical appliance of any kind is sterility; the criterion of a successful operation is union of the wound by first intention and without fever. Mr. C. B. Lockwood, whose able and exhaustive contributions to the principles and details of aseptic surgery are well known, has shown that a wound which has healed by first intention can often nevertheless be proved to contain living organisms. He applies to wounds the severe test of dropping a suture after removal into a culture medium; if growth results he regards his operative technique as at fault, even if the wound has healed by first intention. But a surgical operation is not merely a bacteriological experiment, and it is doubtful whether we can ever depend upon keeping wounds sterile for a week or more after an operation. Fortunately this is not necessary in order to obtain satisfactory results, but one cannot fail to admire the stringent tests which Lockwood imposes upon his own work, and the high ideal of surgical cleanliness at which he aims.

Antisepsis and Asepsis.—These words, which are in such common use, are employed loosely and without attention to their literal meaning. Antiseptic (derivation: *αντι*, against; *σεψις*, putrefaction) strictly means anything capable of combating the process of putrefaction; as used by most persons to-day, it signifies disinfection by means of chemical agents. Aseptic, on the other hand (derivation: *α*, privative; *σεψις*, putrefaction), strictly means anything which is free from putrefaction; as commonly used at the present time, it implies disinfection by means of heat, and without the use of chemical agents. This distinction is entirely artificial, and can only be excused by convenience. The aseptic ideal, literally interpreted, is to operate in a field from which organisms have previously been totally extirpated; the antiseptic ideal, literally interpreted, is a much lower one, viz. to supply a chemical antidote to the germs which are present. But even if germs can be rigidly excluded from the surroundings of the patient, they may still be present in the tissues of the part operated upon; and Prof. Watson Cheyne has well said: "Aseptic surgery is directed to the maintenance of an aseptic condition of the tissues presumably existing at the time of the operation; this method can therefore only have to do with operation wounds made into non-infected tissues through unbroken skin." An aseptic operation would, therefore, be impossible in the case of a large class of conditions which require surgical relief, such as necrosis of bone and suppuration in any organ. But when using the words in the sense in which they are commonly employed asepsis is of itself insufficient, for no operation can be carried through without employing antiseptic as well as aseptic methods, *i.e.* chemical disinfectants must be used as well as heat. In no sense, therefore, can a modern operation be said to be purely aseptic, if any definite meaning at all is to be applied to the term. As labels to the two great classes of methods of disinfection, the terms antiseptic and aseptic are sufficiently convenient to be retained in general use, and no doubt we shall continue to employ them for this purpose.

Much has been written and many experiments made upon the relative values of heat and chemical disinfectants to the practical surgeon. No other method of destroying germs can, however, compare with these two, and in point of fact no others are at the present time in common use for general surgical purposes. Filtration through porcelain (Pasteur-Chamberlain) or through prepared silica (Berkfeld) serves to remove germs and their spores from water, and is made use of for many minor purposes; but this method will probably never supersede the safe, simple, and economical sterilisation of water by boiling. In large hospitals, furnished with a hot-water supply from a high-pressure boiler, the water in the pipes is actually boiled water, and under such circumstances a Berkfeld filter fitted to a hot-water tap would appear to be a safe and ready means of furnishing a practically unlimited supply of sterilised water, which has been both boiled and filtered. But this is only applicable to large institutions, and in the case of operations in private houses filtration is not available, and water must always be boiled before use. Whether the germicidal action of light or of certain non-luminous rays of the spectrum will ever be economically applied to the problems of surgical sterilisation the future alone will show; up to the present time no such use has been made of them.

By heat, therefore, or by the use of chemical disinfectants, all sterilisation must for the present be worked out; and we have now to inquire to what special purposes each can be most suitably applied. In the early days of antiseptic surgery, heat as a disinfectant was entirely ignored, and chemical reagents in strong solution were employed for all purposes. When the usefulness and applicability of heat came to be realised the inevitable reaction against chemicals set in, and some extremists endeavoured to eliminate chemical disinfectants altogether from their practice. Experience has, however, shown this to be impracticable, and it is now universally admitted that the use of both methods ensures the greatest practicable amount of safety, and gives the best results. Some purposes are best served by the use of heat, others by the use of chemicals; but all that the surgeon requires cannot be effected by one method alone.

The effect of *heat* in destroying bacteria has been the subject of many experiments. The organisms usually experimented with have been, not the ordinary pyogenic organisms with which the surgeon is chiefly concerned, but certain forms of bacteria whose powers of resistance are of an unusually high order. Non-spore-bearing organisms, such as cocci, are much more easily destroyed than are the spores of certain resistant organisms, such as the bacillus anthracis, the bacillus tetani, and the tubercle bacillus—the forms which have been chiefly used in the experiments referred to. We need, accordingly, have no hesitation in applying these experimental results to surgical work, for a method which is capable of destroying the spores of the bacillus anthracis may be safely relied upon to destroy streptococci and staphylococci.

It has been made perfectly clear that moist heat is much more effective than dry heat, therefore boiling or steaming is to be preferred to baking. A dry heat of 180° C. maintained for thirty minutes is required to destroy organisms which can readily be killed by boiling them in water at 100° C. for five minutes (Lockwood). And, further, Vinay has shown that most of the pathogenic organisms can be destroyed by exposing them to a moist heat of 64° C. for ten minutes; but spore-bearing organisms require fifteen minutes' boiling at 100° C. to ensure their destruction. When dry heat is used for surgical purposes complicated and expensive apparatus is required, as the high temperature which is necessary cannot be attained except in specially-constructed vessels capable of resisting high pressure; moreover, such temperatures injure metal instruments, and render glass red-hot. Moist heat is much more conveniently and economically applied; and since its effect is more rapid than that of dry heat, it may be said to be in all respects the better method. The relative advantages of boiling and steaming pretty well balance one another. Such articles as bedding and clothing, which would be destroyed by boiling, can be efficiently disinfected without damage by superheated steam. Steam can also be applied readily to the disinfection of dressings, swabs, towels, bandages, etc., in small portable sterilisers, which the surgeon can carry with him to his operations. In using steam for these purposes it must, however, be borne in mind that tightly-rolled towels, reels of silk, and bandages are not readily penetrated by steam, and the deeper parts may escape complete disinfection. Koch found that at a distance of 1 cm. above the surface of water boiling in a deep *open* vessel, the temperature of the steam was only 70° to 78° C. But in the ordinary closed sterilisers the temperature attained in parts farthest from the boiling water is very little below the boiling-point. All articles which can be boiled without injury should be sterilised in this manner, for when the articles are immersed in boiling water there is no loophole for failure. The addition of one drachm of ordinary washing soda to each pint of water to be boiled has the advantage of slightly raising the boiling-point, *i.e.* of ensuring a rather higher temperature than 100° C. In addition it has the minor advantages of protecting metal instruments from rusting, and of readily dissolving grease.

Experiments carefully organised and carried out with the most minute precautions have shown that it is much more difficult to destroy micro-organisms by the use of chemical reagents than by the use of heat. We now know that the earlier experiments which were published upon the germicidal powers of certain well-known disinfectants were vitiated by an unperceived error in method. This was especially the case with corrosive sublimate, and as a result the germicidal powers of this substance were greatly overrated. The method of experimentation adopted was to soak linen threads in a solution containing a virulent culture of some spore-bearing organism, such as the bacillus anthracis; this thread was carefully dried and then soaked in a solution of the corrosive sublimate. Afterwards the thread was sometimes washed with sterile water, sometimes not, and then used for the inoculation of culture media. The fallacy of the method lay in the fact that after being soaked in the solution of corrosive sublimate the thread became permeated with the salt, and therefore when dropped into the culture medium it contained an excess of the antiseptic—an excess sufficient to inhibit the growth of organisms still living, and thus to produce the erroneous belief that they had been destroyed. To remove this excess the threads should be washed in a sterile solution of ammonium sulphide; the germicidal power of corrosive sublimate will then be shown to be much less than was formerly supposed. Thus Kanthack showed that when the precaution named above is taken the bacillus anthracis can be grown from threads soaked for four hours in a solution of corrosive sublimate 1-1000. Behring, however, found that in a solution of 1-100, corrosive sublimate would destroy anthrax spores in twenty minutes. Evans has shown that to destroy the staphylococcus pyogenes aureus it is necessary to expose it for fifteen minutes to the action of corrosive sublimate solution of 1-150 to 1-200; solutions of 1-500 to 1-600, after acting upon it for twenty-four hours, impair the vitality of the organism but do not kill it; weaker solutions than this have no effect whatever. Mr. Leedham-Green, the author of some admirable researches upon the surgical methods of disinfecting the hands, has recently declared that, in test-tube experiments, solutions of sublimate 1-1000, of biniodide 1-1000, of carbolic acid 1-40, and of lysol 1-500, have practically no germicidal effect upon living organisms unless these are exposed to their action for a prolonged period. But although it is so difficult to destroy micro-organisms in this manner, it is possible to arrest their development by comparatively weak solutions; thus Miguel prevented the multiplication of bacteria in meat infusion by adding 1 part of sublimate to 14,000 parts. This effect, however, amounts merely to a temporary attenuation of the organism; and inasmuch as it may lead to a false impression of security it becomes a positive disadvantage.

Another important point which has been established is that isolated organisms, such as those present upon artificially dried and infected threads, are much more easily destroyed by chemicals than are those present in nutritive solutions. As we shall see, germicides are now mostly used for the sterilisation of skin and infected tissues; and on account of the nutritive value of the tissue fluids, organisms present in these localities are more difficult to deal with. Further, germs present in the living tissues are probably more virulent, and therefore more difficult to destroy, than those grown under artificial conditions.

Lastly, the question of quantity must be borne in mind, the importance of which has been conclusively shown by Prof. Watson Cheyne. A certain amount of germicide is capable of dealing with a certain number of organisms only, their destruction involving something approaching to a chemical reaction between the organisms and the poison; therefore the more numerous they are the more difficult is it to destroy them by chemical agents. This objection obviously does not apply to sterilisation by heat. But as the quantity of bacteria present cannot be estimated by any means at our disposal in surgical work, no practicable method of determining the amount of the germicide required for their destruction is available. This is an obvious disadvantage, because the effects of bacterial invasion of the tissues are proportionate to the number as well as to the virulence of the organisms which gain access to them.

Into the relative merits of the disinfectants in general use we cannot enter fully, but the question will be briefly referred to in describing the methods of sterilisation of the hands. For such a purpose a germicide is required which, *first*, may be relied upon to destroy the micro-organisms present, and, *secondly*, will not injure the skin itself. The question cannot, therefore, be properly considered simply as a bacteriological problem.

We have, therefore, now to consider the bearing of the foregoing facts and considerations upon the details of gynæcological surgery. The organisation of an antiseptic operation must be of necessity a matter requiring care and forethought in every instance; often variations of a minor character must be introduced to meet the requirements of different cases. Uniformity in detail is by no means to be found among operators of equal experience and of equal success, and in regard to many details it may be said that the particular method of sterilisation adopted is not of so much importance as the degree of care and thoroughness with which it is carried out. We shall therefore endeavour, in describing methods, to indicate those which have been proved by experiment and experience to be safe, without entering into the question of the relative merits of the many possible plans which may be followed.

The following order of considering the numerous operative details which come up for discussion will be adopted:—

I. *The surroundings of the patient.*
II. *The sterilisation of the surgeon's armamentarium.*
III. *The sterilisation of the hands.*
IV. *The sterilisation of the field of operation.*
V. *The protection of the wound.*

I. The Surroundings of the Patient.—To consider the details of the construction of an operating theatre would be foreign to the purpose of this article. A few considerations with regard to operations in private houses, *i.e.* in rooms not constructed with a view to the surgeon's convenience, may, however, be usefully set forth. Light is one of the first surgical requisites, and a room with ample window-space should be selected. In London, daylight cannot be relied upon at certain times of the year, and the provision of adequate artificial light is a matter which must not be neglected. Portable electric lights can easily be obtained if it is necessary to supplement the resources of the dwelling. A light room having been selected, all superfluous furniture should be removed in order to allow space for free movement during the operation, and to increase the air-capacity of the room. Carpets should be taken up, and all curtains and bed- or table-hangings removed, along with everything else which can harbour dust. The floor should then be scrubbed, and the doors, wainscoting, and windows thoroughly cleansed. This should be done the day before the operation, and the room then left undisturbed until the actual preparations for the operation have to be begun, in order to allow of the deposition of particles of dust from the atmosphere. Any dust which may be thus deposited will not be disturbed by the ordinary air currents caused by ventilation, or by the movements of the occupants of the room. In cases of emergency, where there is no time for these preparations, a clean dust-sheet should be spread over the carpet, completely covering it. As we have already seen, dust is not much to be feared as the carrier of infection, except that from a room recently occupied by an infected person. The air of a cleanly dwelling-house is indeed much less likely to contain pathogenic organisms than the air of a hospital ward or operating theatre. It is, in part, on account of the infected atmospheric conditions present in hospitals, that elaborate precautions are necessary in the construction of operating theatres; the aim being to provide surfaces least likely to collect dust, and capable of being most readily cleansed. In the case of an operation involving the opening of the peritoneal cavity, the temperature of the room should be carefully maintained at not less than 70° F.; the exposure of the abdominal viscera to a lower temperature than this increases shock, and by depressing the vitality of the peritoneal membrane may reduce the force of one of nature's most important defences against infection. The ventilation of the operating room is subsidiary to the temperature, but subject to the maintenance of the temperature as much change of air as possible should of course be allowed. It may also be pointed out that the risks of air infection during operation, which we can never entirely eliminate, may be further diminished by rapidity in work, and by the protection of wounds and exposed viscera, so far as may be practicable, by covering them with sterile swabs or guards.

Attention has recently been directed to the ejection from the mouth in the act of speaking of minute particles of saliva; such particles frequently carry with them organisms which can be grown upon suitable media. If, while speaking, a prepared open culture plate is held close to the mouth, numerous colonies of bacteria will in time appear upon it. It has therefore been argued that here is a new and unexpected source of danger, for in giving necessary directions during the operation the surgeon may infect the wound from his own mouth; as we have seen that pyogenic organisms may occur in the mouths and throats of healthy persons, it is obvious that as a source of danger, talking cannot be entirely neglected. Surgeons have been urged to wear masks while operating to prevent the ejection of particles of saliva, and Mendès de

Leon has invented one of a convenient pattern. But if talking be limited to what is necessary, and if reasonable care be taken to avoid speaking into a wound as one speaks into the receiver of a telephone, the risks of infection from this source are probably negligible.

Another possible source of infection from surroundings must be mentioned, viz. the possibility of particles of dust falling from the hair of the operator or his assistant into the wound. This may be readily avoided by wearing during the operation a sterilised linen cap pushed well down over the temples so as to cover the hair.

Furniture of the operating room.—While hospital operating theatres are now furnished with expensive and so-called "aseptic" furniture, the surgeon when operating in a private house has to be content with much more humble appliances than these, and he does equally well without them. For pelvic operations a table upon which the patient can be placed in the Trendelenburg position is indispensable on account of the easy access to the pelvic organs which this position allows. In London such tables, made in simple style of enamelled iron, can be hired from an instrument-maker; or the surgeon may find it to his advantage to keep his own table, and send it when required to his patient's house. Light, portable wooden tables are also made which can be comparatively easily carried, but these lack the necessary stability. In an emergency a kitchen-table may have to be used, and a portable wooden frame can be obtained which, being fixed to the table, allows the patient to be placed upon it in the Trendelenburg position. For his instruments and other materials, ordinary small tables covered with clean sheets or towels will suffice.

II. The Sterilisation of the Surgeon's Armamentarium.—The term armamentarium is here intended to include everything that is made use of during an operation, viz. sutures and ligatures, instruments, sponges or swabs, dressings and bandages, towels and other coverings such as aprons and sheets, bowls, basins, trays, and lastly water. The sterilisation of all these articles before operation, and the preservation of their sterility throughout the operation, are matters of the greatest importance. The same methods cannot be applied to all, and it will therefore be necessary to enter into this part of the subject in some detail. It may, however, be premised that nearly all articles may be sterilised by heat, and are in practice most conveniently and safely dealt with in this way. Instruments are most conveniently sterilised by boiling; swabs, dressings, towels, etc., by steam.

(*a*) *Apparatus.*—The apparatus required for boiling instruments is of the simplest possible kind; a domestic fish-kettle answers the purpose perfectly well, or small portable metal sterilisers can be carried to the house and heated over spirit-lamps. No description of this simple apparatus is required. Sterilisation by steam requires more complicated appliances. In hospitals, where large quantities of material of various kinds have to be prepared, a large receptacle is required, and in such it is a great advantage for the steam to be retained under pressure in order to ensure that it will penetrate the contents thoroughly, and to raise its temperature above the boiling-point. This apparatus is known as the autoclave, or high-pressure steam steriliser; it is heated by gas, and is capable of raising steam to

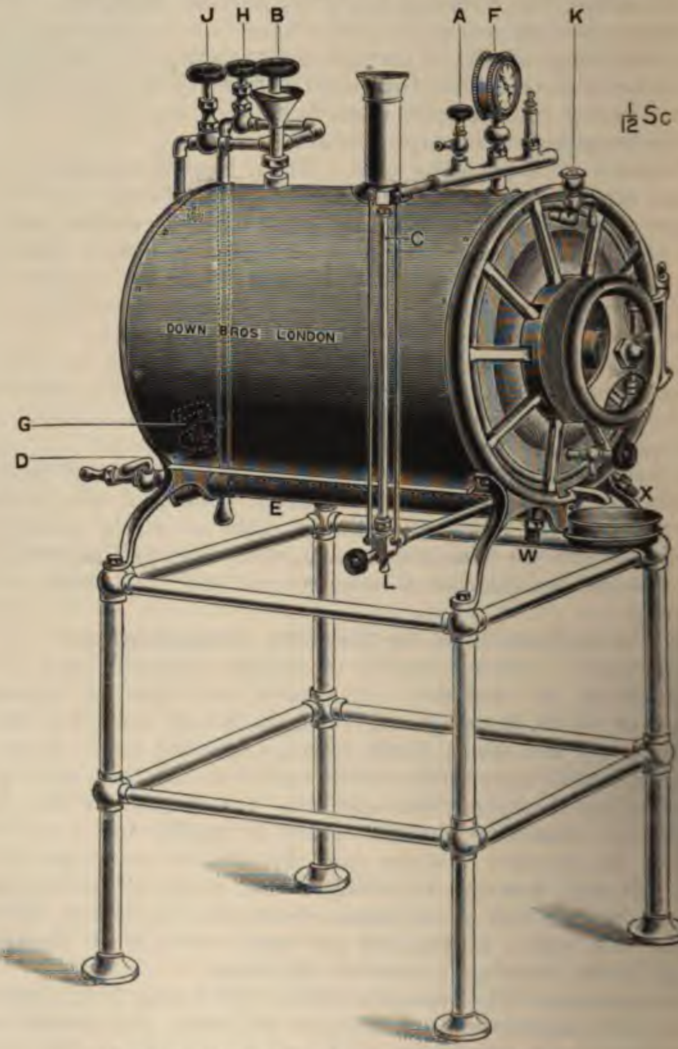
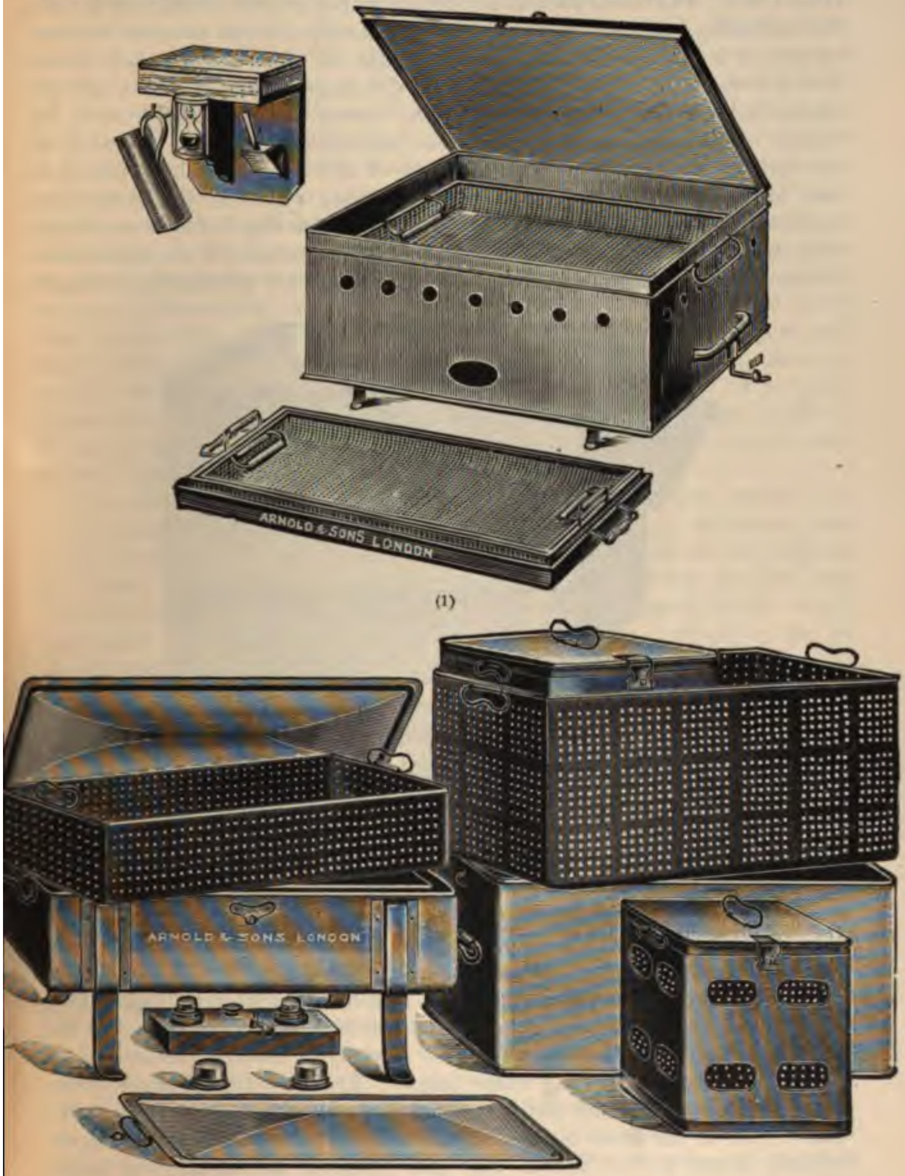


FIG. 179.—Autoclave or High-pressure Steam Steriliser.

a temperature of 250° F. under a pressure of 15 lbs. or more (Fig. 179). It is unnecessary for the surgeon's private work, and is only required, as has been said, for the sterilisation of large quantities or varieties of articles. Small portable steam sterilisers may be obtained which serve well enough for the sterilisation of the materials required for a single



(1)

(2)

FIG. 180.—Schimmelbusch's Steam Steriliser.—(1) For boiling instruments only; (2) For boiling instruments and steaming dressings simultaneously.

operation. One of the best of these is Schimmelbusch's apparatus, which may be used for sterilising instruments as well as dressings and swabs (Fig. 180). The lower part of the apparatus consists of an ordinary kettle for sterilising instruments; upon this fits closely a metal case the bottom of which is detachable, and into this case fit two cubical metal boxes which will hold all the swabs and dressings required for a single abdominal section. The sides of the boxes are perforated, and by means of an outer sliding case the perforations can be exposed or covered up at will; thus the contents of the boxes may be exposed to the action of steam produced by the boiling water in the kettle immediately beneath them. The steam penetrates the boxes completely, and escapes from beneath the lid of the upper portion of the apparatus. When the perforations are covered up the boxes are practically air-tight,

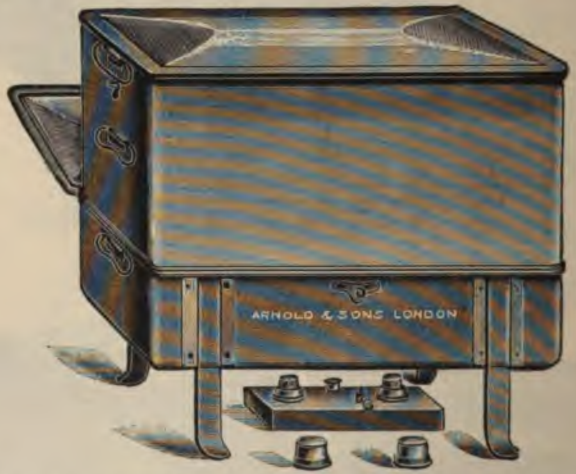


FIG. 181.—Schimmelbusch's Steam Steriliser.—(3) Shows No. 2 complete and in use.

and can be carried to the operation and opened when required. The sterilisation should be done immediately before the operation, or as nearly so as possible; and a box which has not been opened should be resterilised when required for a subsequent operation.

The method of using Schimmelbusch's steam steriliser is as follows: The lower receptacle for instruments is filled two-thirds full of boiling water, and the spirit-lamp lighted beneath it. The outer frame of the dressing-steriliser is then fitted on, and allowed to become well heated by the steam from the boiling water below. The two cubical boxes, previously packed, with their slides open, are then fitted into the receptacle, and the lid of the latter closed. Time must be allowed for the air in the cubical boxes to be driven out and replaced by steam. If air is allowed to remain the disinfecting power of the steam is greatly diminished. Not until steam issues smartly from beneath the lid can the sterilising process be said to have begun. Half an hour is then allowed for sterilisation. When the sterilisation is finished, the boxes are removed, and the perforations closed by pulling down the slide. The efficiency of the apparatus can be readily tested. By packing up a thermometer among the dressings in the centre of one of the boxes, I have found that a temperature of 210° F. can be obtained with certainty even in the position least easily reached by the steam; the temperature at the sides of the boxes rises no doubt fully up to 212°. Repeated bacteriological tests have also been made with my own apparatus with perfectly satisfactory results. Two prepared tubes of agar inoculated with a virulent culture of the organisms selected are obtained from the bacteriological laboratory. One is used as a control, for if the organisms do not grow in it the test is worthless; the other is packed up among the dressings in one of the cubical boxes, and then subjected to the action of the steam for half an hour. The tubes are then returned to the bacteriologist, and the sterilised ones subjected to a careful test, the agar being broken up with a sterile glass rod so as to expose as great a surface as possible, then filled up with sterile broth and incubated for three days at 37° C. Then fresh agar tubes are inoculated from the sterilised ones as a subsidiary test.

In this way I have made tests with staphylococcus aureus, the most resistant of all the pyogenic cocci, bacillus coli communis, and cholera vibrio, and not once has the sterilised tube shown any sign of growth. The test is a stringent one, for the tube being plugged with cotton-wool, steam does not enter it nearly so readily as it would permeate the loosely-packed dressings; there can, therefore, be no doubt that this apparatus enables the surgeon to thoroughly sterilise the dressings and swabs he may require for any abdominal operation. If towels, aprons, and articles of close texture are to be sterilised they must not be packed in the boxes folded up, but must first be opened out and packed loosely, or the steam will not penetrate them thoroughly. Although the apparatus only sterilises two boxes at once, the surgeon may prepare as many as may be required to hold the material he intends to use, and they may be kept closed until the operation. After the steaming is over the sliding case may be closed at once, in which case the dressings will when used be a little damp, or they may be allowed to remain open for three minutes, when the steam will escape, and the dressings become practically dry. Instruments can be sterilised simultaneously by placing them in the water boiling in the lower receptacle, or the instrument steriliser may be detached and subsequently used alone.

The sterilisation by steam of infected clothing and bedding—including mattresses, bolsters, pillows, and blankets—is one of the most important of surgical precautions, and should be insisted upon in private work after cases of septicæmia, and after all cases of surgical infection of whatever kind. Such articles are potent agents in the dissemination of pyogenic organisms in a state of virulence, and may unwittingly become the cause of disasters in cases where the connection would be difficult, if not impossible, to trace. Such measures will, no doubt, in time be insisted upon by the public health authority in cases of surgical infection as much as in infectious medical diseases; in hospitals and private nursing houses it is, of course, the invariable practice even now. For this purpose large apparatus is required, which is provided for the purpose by the sanitary authority, and is now also furnished by private enterprise.

(*b*) *Sterilisation of Instruments.*—Metal, glass, and rubber instruments can all be boiled without injury. They should first be scrubbed in hot soap and water with a sterile nail-brush in order to remove grease and other forms of dirt; no article which is not first cleansed of dirt can be sterilised efficiently either by boiling or the use of chemicals. Glass instruments cannot be dropped into boiling water or they will crack; other kinds can be dropped at once into boiling water. The water in the vessel must be deep enough to cover all the instruments completely, and the boiling should then be continued for fifteen minutes; this time is required for the destruction of spores, but, as we have seen, the non-sporing cocci are destroyed much more rapidly. Perfect safety is therefore ensured by fifteen minutes' boiling. The addition of ℥j. of washing soda to each pint of water has advantages which have already been pointed out. The edges of cutting instruments and the points of needles are blunted by boiling for fifteen minutes; this effect can to a great extent be prevented by wrapping knife-blades, scissors, and needles in lint before placing them in the steriliser. Before the same set of instruments is used for the next operation—if several are performed consecutively—the scrubbing and boiling must be repeated: if the operation has not been concerned with infected tissues five minutes' boiling will suffice; but if the case has been one of suppuration or other form of infection, or has involved the alimentary canal, fifteen minutes' boiling will again be required. All forceps and scissors which have detachable blades should be separated before being scrubbed in order to ensure proper cleansing of the locks; they may then be refitted before being boiled. Instruments can, of course, be perfectly well sterilised in the autoclave by means of steam, but this method is not so convenient as boiling, and possesses no compensating advantages.

Instruments should, whenever possible, be boiled immediately before the operation, while the surgeon is sterilising his hands and the patient is being anæsthetised; they can then be lifted out in the wire tray of the steriliser, and placed directly in the instrument tray for the surgeon's use without coming into contact with anything in transit. In private cases, if a portable steriliser is not available, the instruments may be sterilised at home by the surgeon or his assistant; then tilted into a sterilised towel without handling, packed up in this, and then wrapped round with a piece of fresh macintosh, and carried thus to the operation. They are then dropped directly from the sterilised towel into the instrument tray when the surgeon is ready to use them. It is preferable, however, to boil them in the operating room, for sterilised instruments should not be touched except by sterilised hands, and their transportation, however carefully conducted, involves additional risks.

During the operation the instruments must be carefully preserved from reinfection. Some surgeons immerse them in trays of weak carbolic solution, 1-60; others are content with sterilised water, holding that the risk of contact with air is negligible. They should be handled by no one, if possible, except the surgeon and his assistant; a third assistant may be required to thread needles. Instruments dropped during an operation should be abandoned altogether for that operation; hasty sterilisation, as we sometimes observe it done by a nurse under such circumstances, is a snare to the surgeon, and may have disastrous consequences. An instrument which has touched the floor must before being used again be first scrubbed, and then boiled for fifteen minutes. Clips and safety-pins used for fixing towels round the field of operation, and all kinds of drainage-tubes, must be regarded as instruments within the meaning of this section.

(*c*) *Sterilisation of Sutures and Ligatures.*—The materials in common use for purposes of suture and ligation are silk, silkworm gut, and catgut. In this country the first named is employed far more widely and generally than any of the others. It is applicable to all purposes, can be readily and efficiently sterilised by boiling, is inexpensive, and very strong in proportion to its bulk. Its one disadvantage is that it is practically unabsorbable by all tissues, except, perhaps, the peritoneum. When, however, it is buried in healthy tissues in a condition of absolute sterilisation, it gives rise to no trouble, and remains as an inert foreign body, or is slowly broken up by leucocytic invasion. If, however, the silk is contaminated when used, or is buried in infected tissues, it may become a focus of suppuration, keeping open a sinus communicating with the surface; or it may pass by ulceration from its original position into adjacent hollow viscera, and be thence discharged from the body. Thus instances have occurred where, after pelvic operations, silk ligatures have long afterwards escaped through the bladder or rectum; and Mr. Bland-Sutton has recorded a remarkable case in which he believed that a ligature placed upon a Fallopian tube became discharged long afterwards through the uterus during menstruation. These occurrences are, however, sufficiently rare to prevent them from being regarded as serious objections to the use of silk.

Catgut is commonly used for the same purposes as silk in Continental clinics and in the United States. The great advantage of catgut is that it is absorbable by the tissues, and thus cannot be followed by the untoward results just referred to in the case of silk. This quality, however, has its disadvantages, for the buried suture may become absorbed before the tissues have firmly united. Artificial means to increase its resistance to absorption are now successfully employed, which enable it to endure until repair has been completed. As we shall see later, this involves elaborate preparation of the gut. Another disadvantage is that there is no simple and efficient means of sterilising it, and of maintaining it sterilised until required for use; in this important respect it compares unfavourably with silk. Sir William Macewen has recently pointed out, in an address to the

British Medical Association, that the ideal surgical suture should be (1) strong enough to keep the tissues in contact for the requisite period; (2) sterile; (3) absorbable; and he claimed that catgut fulfils all these indications. In some interesting experiments he showed in detail the process of absorption of catgut by leucocytes, which commences in twenty-four hours, and takes a variable amount of time for its completion. He believed that catgut hardened sufficiently to remain for ten days in the tissues will meet all the requirements of abdominal surgery, and described the method he himself employed for hardening and sterilising it. In using the ordinary chromicised catgut of commerce in plastic surgical operations it must, however, be remembered that the sutures will hold for only one-third as long in mucous membranes as in skin, or when buried in the tissues.

Silkworm gut may be employed wherever an unusually strong and resistant suture is required; it is unsuitable for use as a ligature. It resists absorption by the tissues for months, and even years, but this is certainly not invariable; sometimes on reopening an abdominal cicatrix, the fascial layer of which had been united by buried silkworm gut, no trace of the sutures can be found. It can be sterilised by boiling, and can be obtained in suitable sizes. It is much the best material to use for the deep skin sutures in the operation of perineorrhaphy.

It may be regarded as an axiom that the surgeon should personally supervise the sterilisation of all the ligatures he uses, and not depend upon commercial sources for his supplies. Silk should be lightly wound upon small pledgets of lint, and then boiled; if tightly wound upon reels the deeper layers will be with difficulty reached by the boiling water; lint is preferable to glass or metal bobbins, as it does not impede the access of the boiling water to all parts of the silk. Fresh silk should be boiled for at least half an hour before being used, and then taken out of the boiling water with sterilised forceps, and preserved in a bottle containing sufficient 1-40 carbolic to submerge it completely. Soda must not be used in boiling silk, as it is apt to make it rotten; therefore instruments and silk cannot be sterilised together. A second boiling immediately before use is advisable, and it is a good practice in abdominal operations to reboil the previously sterilised silk for a few moments in fresh water after the instruments have been removed from the steriliser; and as it is not usually required during the first steps of the operation, no time is thereby lost. Silk which has been retained for two to three weeks in carbolic solution becomes discoloured, and is apt also to prove rotten. Some surgeons boil their silk in 1-1000 perchloride or biniodide of mercury solution to make doubly sure of its efficient sterilisation. Lockwood says, however, that silk saturated in carbolic or perchloride is apt to cause a good deal of irritation when used in uniting the skin. Apart from this, there can be no objection to boiling it in the antiseptic solution instead of in plain water. After the second boiling immediately before use, the ligatures can be tilted into a dish of sterilised water, or 1-60 carbolic solution, whence they can be taken as required by the surgeon or his assistant.

There are many methods of sterilising catgut, but the process is a difficult and complicated one, and has the serious disadvantage that it cannot well be carried out by the surgeon himself or under his personal supervision. The surgical instrument-maker must usually be trusted to prepare it,—a serious objection, for the surgeon should be himself satisfied that everything has been done that is possible to ensure sterility. The main difficulty is that catgut is destroyed by boiling, and also by dry heat at high temperatures, and its texture is so affected by strong solutions of powerful germicides as to be made rotten and unfit for use. Other devices have therefore to be employed. One of the simplest is the method used by Lockwood; this consists of three stages: (1) well rubbing the raw catgut in soap and water; (2) soaking it in methylated ether for forty-eight hours to remove grease; (3) soaking for at least seventy-two hours in an aqueous solution 1-250 of biniodide of mercury. In this solution Lockwood says it may be kept for months without any apparent alteration; but this opinion is contrary to the experience of most surgeons. It will be noted that this surgeon does not harden his catgut artificially before sterilisation, but as he employs it only for septic and tuberculous wounds, and for operations upon the peritoneum and rectum, it is not required to resist absorption for ten days. He has found that catgut prepared in this manner is always sterile.

After having been freed from grease, the gut is usually first hardened by immersion in a watery solution of chromic acid for a period varying from twelve to forty-eight hours or more, according to the degree of resistance required. Thus "seven day," "ten day," and "twenty day catgut" can be purchased from instrument-makers, but there is only the dictum of the manufacturer to be relied upon for the accuracy of the calculation. Exact observations on the conditions which decrease the absorbability of this material have never been made. The chromicised gut can be sterilised more or less efficiently in a variety of ways too numerous to mention; the following are probably the most reliable:—

Method of Répin.—The details of this method, which was worked out at the Institut Pasteur in Paris, are comparatively simple. The gut is first thoroughly cleansed of all grease by treatment with carbon bisulphide or ether; then it may be chromicised if desired; next it is dried in a stove at a moderate temperature. The dried gut is then placed in a prepared narrow tube of thin glass containing a small quantity of absolute alcohol; the end of the tube is sealed in the flame, and the sealed tube then placed in the autoclave, and subjected for an hour to a temperature of 120° C. The vapour of alcohol thus evolved and retained in the sealed tube under pressure, is the sterilising agent. According to Répin, this method gives absolute security in sterilisation. Another great advantage is that the problem of preserving the sterilised gut from contamination until required for use is also solved by this method, for it may be preserved in the sealed tubes for any length of time. Labadie-Lagrave and Legueu, who report upon this method, advise the use of 90 per cent alcohol, instead of absolute alcohol, to prevent the gut from becoming brittle. No other method promises so well as this, for the gut is sterilised in a sealed tube, and need not again be handled until required for use.

Formalin and *cumol* (an oily hydrocarbon) are also employed to sterilise catgut, but these methods are open to considerable objection. The cumol method was introduced by Krönig, and, as modified by Clark and Miller, is carried out as follows: (1) The gut is rolled into a figure of 8, so as to fit into a test-tube; (2) it is subjected to dry heat at a temperature of 80° C. for an hour; (3) it is dipped into cumol at 100° C., the vessel sealed, and the temperature raised to 165° C. and maintained at that temperature for an hour; (4) the gut is transferred to the hot-air chamber at 100° C. for two hours; (5) the dried gut is placed in sterile tubes for preservation. It will be seen that this method involves handling of the sterilised gut, and does not provide for its safe preservation from contamination afterwards. Cumol catgut thus prepared must be preserved in a dry state.

In the formalin process the gut is cleansed of grease by soaking in benzine, the excess removed by blotting-paper, and the gut then soaked in cold sterilised water for two hours; next it is placed for sixteen hours in 5 per cent formalin, rinsed in running water for five or six days, and then preserved in metal tubes containing alcohol and glycerine, nine parts of the former to one of the latter; finally, these tubes can be placed with the dressings in the steriliser before being used for an operation. Mr. Mayo Robson and Dr. Jellett have devised methods of sterilising catgut by the action of the vapour of xylol and absolute alcohol respectively. These do not differ in principle from the method of Répin, but are much inferior to it in detail.

It will be seen from what has been said that the simplicity with which silk can be sterilised by the surgeon himself is a very strong argument in favour of its use for general purposes instead of catgut. Silkworm gut can be boiled without injury, and therefore requires no other form of sterilisation. It is, however, rather difficult to sterilise completely, and should be boiled for half an hour on two occasions before being used. Soda solution destroys its toughness, but it can be preserved in 1-40 carbolic acid solution for months without injury, and reboiled at any time it may be required. It is by far the most resistant of the three common forms of suture, and is generally used when a durable stitch is required. It is practically impermeable, and in this respect presents advantages over silk for the operation of perineorrhaphy, as deep silk sutures tied on the skin surface of the perineum are apt to act as conductors of infection from the surface to the deeper parts of the wound. The perineum is a part which cannot be kept sterile for any length of time, but in other positions, such as the abdominal wall, the permeability of the suture is unimportant, as the field of operation can be adequately protected from contamination until the sutures have been removed.

(*d*) *Pads, Swabs, and Sponges.*—Marine sponges were in universal use for all purposes until the value of heat as a sterilising agent became recognised. At the present time, however, they are used by very few surgeons owing to the difficulty of sterilising them, but one or two distinguished English surgeons, *e.g.* Prof. Watson Cheyne and Mr. Lockwood, still exclusively employ them. There are two substitutes for the marine sponges, viz. (1) artificially-prepared pads or compresses of various sizes composed of cotton-wool, or Gamgee tissue enclosed in layers of gauze; (2) swabs composed of several layers of dry sterilised gauze. It is worth while to consider briefly the relative advantages of all three.

Marine sponges.—There can be no doubt that no other material has the same capacity as the marine sponge for soaking up blood and other fluids; but from every other point of view it is inferior to both the alternative materials. Its sterilisation is difficult and tedious, and requires extreme care in supervision. Sponges are prepared for surgical use by Lockwood in the following manner:—(1) They are shaken and beaten to get rid of sand; (2) soaked in dilute hydrochloric acid to remove shell and coral; (3) washed out in alkaline water (℥j. of washing soda to Oj. of water); (4) washed in warm sterile water; (5) soaked for twelve hours in cold dilute sulphurous acid 1-5, which is then in turn washed out in sterile water; (6) preserved in 1-20 carbolic lotion until required for use. In this method the sterilising agents are the sulphurous and carbolic acid solutions; the previous steps have, of course, no antiseptic value, and are simply intended to clean the sponges. But we have seen that the destruction of organisms by merely bringing them in contact with antiseptic solutions is by no means easy, and it is difficult to believe that this method, unless carried out with the greatest care, is entirely reliable. Another objection to marine sponges is that it is difficult to cleanse them thoroughly from the blood with which they have become saturated during an operation. Lockwood advises that sponges which have come in contact during operation with pus or fæcal matter should be burnt; others he cleanses by first washing them in alkaline water to dissolve fibrin, etc.,—for which purpose several relays may be required,—and then sterilising them in cold dilute sulphurous acid 1-5, or chlorine water. As carried out under his supervision at St. Bartholomew's Hospital, this method appears to succeed, for forty out of forty-one re-sterilised sponges tested by him were found sterile. It must, therefore, be conceded that in practical and efficient hands marine sponges can be used safely for surgical purposes, but their preparation involves the expenditure of a great amount of time and trouble, for which the advantages they possess do not offer adequate compensation. The finest qualities of sponges are very expensive, too expensive to be destroyed after use except when infected. During operation Lockwood washes out his sponges in aqueous biniodide of mercury solution 1-1000, and they are handed in a bowl of this solution to the surgeon by the nurse whose duty it is to wash them out. Watson

Cheyne washes them out in carbolic lotion during the operation, and allows them to be handled only by the surgeon and his assistant.

Pads or compresses.—The great advantage of using artificially prepared pads instead of marine sponges is that they can be sterilised by boiling water, steam, or dry heat, and that being quite inexpensive they need never be used for more than one operation. They can be prepared in convenient sizes, and a supply of them kept ready for immediate sterilisation when required. In an abdominal section it is convenient to have at least two of large size and moderate thickness, which can be used for isolating the pelvic organs by packing the intestines into the upper part of the pelvi-abdominal cavity. The others may be made of any size which the surgeon finds most convenient. They should be boiled or placed in the steam steriliser for an hour before being used; their shape and texture are better preserved after steaming than after boiling. From the steriliser they should be tipped directly into a vessel containing 1-20 carbolic acid solution, and carried in this to the operation; the time required is too long to allow of their being sterilised like the instruments at the commencement of the operation. From the carbolic acid they are tipped into a basin of sterile water, and returned to this basin to be washed out as required from time to time during the operation; or they may be reboiled for five minutes before use. When the operation is over they are burned, and a new set employed for the next. Although pads of this kind thus possess advantages in simplicity of sterilisation and in cheapness as compared with marine sponges, yet there are one or two disadvantages common to both, which will be pointed out after considering the third alternative method.

Swabs of sterilised gauze.—A large number of square pieces of plain surgical gauze, from 6 to 12 ply in thickness, are prepared, packed in a sterilising box, and steamed in the steriliser for half an hour; gauze being more permeable than cotton-wool, is more quickly sterilised. For packing away the intestines to isolate the pelvic viscera, loose rolls of the same gauze, 6 to 12 ply in thickness, 8 to 12 inches wide, and 3 to 6 yards long may be conveniently employed. Large compresses or sheets of the same thickness, 1 yard long by ½ yard wide, are equally convenient for this purpose. These rolls or sheets are *loosely* packed in a box, and sterilised in the same manner as the swabs. When required, a roll is taken out, packed gradually into the lower abdomen, or wherever it may be required, and the end left outside the abdominal incision; this end may be clipped with a pair of forceps to prevent its being drawn into the peritoneal cavity. The pelvis can in this way be isolated much more thoroughly than with compresses or marine sponges. A swab after being used to take up blood or any other fluid is at once rejected, and a fresh one taken in its place; gauze rolls or sheets may be changed as often as required. The advantages of this method are fairly obvious, and there can be no doubt that it is in practice the soundest and the best. In the first place, it offers a supply of fresh sterile material for use throughout the entire operation from first to last; sponges and pads become saturated with blood, and cannot be thoroughly cleansed by washing during the course of the operation, so that towards its close they are not even approximately surgically clean. They often become infected by pus in pelvic operations where suppuration has occurred, and being continued in use may infect the general peritoneal cavity. Further, Lockwood has found that marine sponges tested at the end of an operation are infected with skin bacteria. The second advantage is that no handling of the sterilised swabs is required by any one except the surgeon and his assistant; the surgeon takes the swabs from the box himself, or they are passed to him by a nurse on a pair of sterilised forceps. As no washing out is required during the operation, swabs are not handled to anything like the same extent as pads and sponges, which must always be washed out repeatedly. If sponges or pads are used, the necessity of counting them both before and after operation, and the personal responsibility of the surgeon for this part of the technique of the operation, have been recently brought home to the profession and need not be insisted upon. Sterile swabs are used in large numbers and cannot well be counted; but if the surgeon is careful not to use anything for packing purposes except the rolls or sheets of gauze, counting is unnecessary, for several yards of material could not be sewn up in the peritoneal cavity except in gross carelessness. The small swabs must be used only for taking up blood, never for packing, and be then immediately thrown away; they need therefore never be left for a moment inside a wound. Gauze possesses less absorptive power than the marine sponge, but this mechanical property is unimportant in comparison with the other considerations set out above.

(*e*) *Sterilisation of Water.*—An abundant supply of sterile water is required for all operations involving the peritoneal cavity. Most surgeons who use artificial sponges wash them out in sterile water during the operation, and frequent renewals are required for this purpose. If normal saline solution be employed to flush the peritoneal cavity or the wound, it must be prepared with sterile water; and, lastly, some surgeons use sterilised water instead of tap-water for scrubbing the hands. Water is most easily and simply sterilised by boiling; it may then be stored in covered vessels, previously sterilised, until required for use. If ordinary jugs or ewers are used, as in private operations, their mouths should be tied over with several layers of sterilised gauze. Cold sterilised water may be raised to the temperature required at the moment by adding boiling water to it. In hospitals a supply of sterilised water may be obtained at any given temperature by means of the Berkfeld filter shown in Fig. 182. The tap B is attached to the hot-water pipe of a high-pressure system, capable of delivering water at a temperature near the boiling-point. The pipe D is the silica filter, in the shape of a hollow closed cylinder. By the pressure in the reservoir the hot water is forced through the porous wall of the filter, and is delivered through the tap C, whence it may be immediately run into vessels, or carried on into the movable reservoir shown in the figure. For cooling the water which is being filtered, the tap A being connected with the cold-water system, cold water is run through the series of spiral tubes surrounding the filter, thus reducing the temperature of the hot filtered water obtained at C. E is a thermometer registering the temperature of the filtered water in D, and by regulating the amount of cold water used, sterilised water can be obtained at any temperature likely to be required for surgical purposes. A high-pressure hot-water system is requisite for the use of this apparatus, in part because the water in the pipes should be boiled water, and in part because high pressure is required in the reservoir to pass the water through the filter. Water both boiled and filtered in this manner is no doubt quite safe for general surgical purposes; but, as we have seen, an efficient substitute can be obtained from ordinary domestic sources. It is only when very large quantities are likely to be required, as in hospitals, that resort need be made to this apparatus.

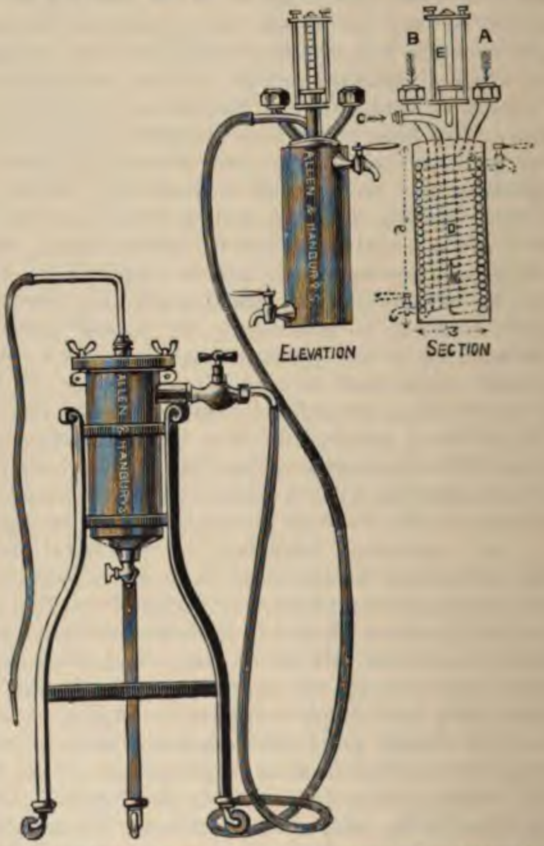


FIG. 182.—Berkfeld's filter with movable reservoir and rubber delivery-tube.

(*f*) *Receptacles*, such as bowls, basins, jugs, cans, and instrument-trays, whenever possible should be sterilised by heat; in hospitals they can be placed in an autoclave for an hour, and removed when required for operation. In private houses they may be baked in an oven. As Lockwood has pointed out, the next best plan is to flame a little methylated spirit in them, a method preferable to merely rinsing them in antiseptic solutions, for particles of dried blood or pus may adhere which are very difficult to sterilise in this way. The minimum requirements will be met by cleansing them first of all with boiling water, and afterwards thoroughly swabbing and rinsing them in 1-20 carbolic, or 1-1000 perchloride solutions.

(*g*) *Aprons, towels, and other coverings, dressings, and bandages*, should all be sterilised by heat, if possible. The surgeon's aprons should be steamed in the autoclave or some smaller steam-steriliser; they may be made of linen or of some waterproof material, such as battist tissue, which can be repeatedly steamed without injury. When sterilised before each operation such aprons can be in frequent use without danger. The towels employed to surround the field of operation may be sterilised by steam and used dry; or they may be boiled and used wet, after wringing them out of 1-40 carbolic. For dressings, plain gauze and wool previously sterilised may be employed; wounds heal with the minimum of superficial irritation when dressed with plain sterilised materials, but this point will be referred to again later on.

III. Sterilisation of the Hands.—Sterilisation of the hands has been amply proved by experience to be the most difficult of all the precautions that the modern surgeon is called upon to fulfil. Obviously the choice of method is somewhat limited, for the antiseptics employed must be fairly rapid in action, and while penetrating the skin thoroughly must not injure it. Heat being out of the question, experiment has ranged widely over the whole field of germicides, with results which can only be regarded as extremely disappointing to the surgeon who wishes to be scientifically aseptic. The net result of a vast amount of careful observation may be said to be; that by no known method can we rely upon the skin of the hands being rendered absolutely sterile; with care and pains, the number of organisms upon them can be reduced to a degree which is perhaps unimportant or even negligible, but farther than this we cannot go.

It must be premised that sterilisation cannot be attempted until rings have been removed and the hands and forearms mechanically cleansed with the most scrupulous care and thoroughness. For this a preliminary scrubbing in soap and hot water, several times renewed, with a sterilised nail-brush for at least ten minutes is required; this not only removes mechanical dirt and grease, but by softening the epidermis allows the removal of the superficial dead epithelial cells which always contain countless numbers of organisms. The water used for this preliminary washing teems with an abundant and varied bacterial flora. Leedham-Green has recently stated that when, after the preliminary scrubbing, strict bacteriological tests are applied the hands appear to be even more contaminated than before, because the organisms in the softened epidermis are more accessible and come away more readily. Mechanical cleansing may be aided by rubbing the hands at the same time with sea-sand or marble dust, more thoroughly to remove dead scales and buried particles of dirt; but when tested the results are found to be no better than when the brush and soap alone are used. All that can be accomplished by mechanical cleansing is that the hands are by it brought into a condition in which disinfectants can act with effect upon the skin. Nevertheless this stage in the process must be conducted with extreme care and pains. The nails must be cut short and skin-tags cut off; the finger-tips, the interdigital folds, the wrists, and forearms must be gone over thoroughly in every part, for it is common enough to find unsterilised areas of skin which have escaped the general process of disinfection. By some surgeons turpentine, benzine, or ether is rubbed on the hands at this stage to ensure the removal of grease; but the skin of the hands possesses very few sebaceous glands, and Leedham-Green found that no better results were obtained with these materials than without them. The use of sterilised water instead of tap-water has also proved to be of little, if any, advantage at this stage; and the numerous antiseptic soaps which have been devised have all been shown to be practically valueless.

The hands, thus prepared, are next rinsed thoroughly in fresh hot water to remove all traces of soap. Soap, being chemically incompatible with corrosive sublimate, greatly impairs the germicidal power of this substance, and if sublimate is used in the subsequent steps of the process this precaution becomes of vital importance. The clean hands and forearms are then immersed in a solution of some antiseptic substance. Even now nothing approaching to uniformity exists among surgeons in the methods employed for this purpose, and among the numerous substances which are in common use the following may be mentioned: perchloride of mercury (corrosive sublimate), biniodide of mercury, sublamin, alcohol, permanganate of potash, carbolic acid, and coal-tar products such as lysol and izal. It will be recollected that experimental work has shown that very strong solutions of the most potent antiseptics are required to destroy bacteria brought into contact with them, and that different varieties of organisms display varying powers of resistance to the action of germicides. Bacteria lying in skin are much more difficult to destroy than test-tube cultures, as numerous observers have shown; it may be that they lie in inaccessible positions in the ducts of the sudoriparous and sebaceous glands or the follicles of the hair, although this is denied by Watson Cheyne; it may be that bacteria in living tissues are more virulent, and therefore less easily destroyed than those grown under artificial conditions. Whatever may be the explanation, it has been made clear that it is extremely difficult to destroy the skin bacteria of the hands by soaking them in antiseptic solutions. Leedham-Green, writing in 1896, reported that after scrubbing the hands with soap and water, and then immersing them for from one to three minutes in 1-1000 sublimate solution, he found the hands sterile in only two out of eleven experiments. These results correspond with those obtained by other observers. Many experiments have also been made upon artificially infected hands, *i.e.* hands inoculated by rubbing over them a quantity of bouillon containing a virulent culture of some organism. In such cases the results have been extremely bad, and it appears to be impossible to render the hands even approximately sterile when starting with an artificially infected condition. The practical bearings of this observation upon surgical work are sufficiently obvious; if the surgeon's hands have become contaminated by an operation upon septic or infected tissues, the greatest possible care will be required in subsequently sterilising them, and probably only by repeating the process two or three times will it be successful. A good deal may be done to prevent the hands becoming contaminated in such cases by the use of rubber gloves during operations, as also for the local examination of cases which are obviously septic or infected. This point will be again referred to later on, but it is obvious that the prevention of contamination is easier than the efficient sterilisation of infected hands.

The most important contribution to the subject in recent years has been the demonstration of the value of alcohol in the sterilisation of the hands. To Ahlfeld belongs the credit of first drawing general attention to it by introducing his method of sterilisation by the use of soap and hot water, followed by immersion of the hands for at least five minutes in alcohol alone. He claimed for his method that it rendered the hands sterile, and could be absolutely relied upon for all surgical purposes. Numerous observers have since subjected his method to stringent bacteriological tests, with the result that it has been found to be defective. Schäffer, one of the most recent investigators, believes that it greatly reduces the numbers of the bacteria in the skin, rendering the hands "*keimarm*"; but even this has been since denied by Füth and Mohaupt, who criticise the methods of Schäffer, and find that by Ahlfeld's process the numbers of bacteria in the skin are not even notably reduced. But although alcohol alone cannot be relied upon to sterilise the skin, it has been shown that when used in combination with more active germicides it is invaluable in assisting their action. Leedham-Green believes that the germicidal action of alcohol is partly real and partly apparent. In test-tube experiments he found that 70 per cent alcohol was quite as destructive to pyogenic cocci as 1-1000 solution of perchloride or biniodide of mercury, so that he believes it to be a germicide of no mean order, capable of exerting a true disinfecting action upon the skin. The apparent effect he explains thus: when the hands, softened by previous scrubbing with soap and hot water, are immersed in alcohol the epidermis becomes much hardened, the alcohol penetrating to the deeper layers; as a result, epidermal scales are more difficult to detach, and the skin consequently does not give up its bacteria so readily to the tests that are then made upon it. And he shows by an interesting experiment that this effect is but temporary. If the hands, after immersion in alcohol, are soaked for a few minutes in a warm sterile solution of saline, or some sterile albuminous fluid, organisms can again be grown freely from them. The effect, therefore, does not last; and this most interesting experiment no doubt explains the diversity of results obtained by other investigators of the alcohol method. In the result it may be said to have been made sufficiently clear that alcohol is a most useful sterilising agent, acting both chemically and mechanically, but that it is not to be relied upon to sterilise the hands when used alone.

The most recent experimental work, therefore, leads to the conclusion that to obtain the best results the auxiliary use of alcohol is necessary in sterilisation of the hands. Thus Fürbinger has advised the following method: (1) Scrubbing with soap and hot water for five minutes; (2) immersion in alcohol for two to three minutes; (3) immersion in a watery solution of corrosive sublimate 1-1000. Leedham-Green varies this process a little, and advises the following: (1) Scrubbing with soap and hot water for five minutes; (2) immersion in methylated spirit for two minutes; (3) immersion in an alcoholic solution of corrosive sublimate for two minutes (70 per cent alcohol charged with 1-1000 corrosive sublimate). By this method he has obtained the best experimental results. Lockwood advises a somewhat similar method; he omits stage (2) of Leedham-Green, and uses in stage (3) a solution of 1-500 biniodide of mercury in 75 per cent alcohol. He claims definite superiority for biniode over perchloride of mercury, in that the former has no coagulating action on albumen, and therefore reaches organisms in tissues or albuminous fluids more readily; minor advantages are that it is less irritating to the skin both of the patient and the surgeon, that it does not destroy steel instruments, and is not incompatible with soap. The alcohol and mercury method may be therefore said to be that which, as far as our present knowledge goes, offers the best assurance of safety.

Although the weight of experimental evidence is against it, there is another method which must be referred to, viz. the permanganate of potash and oxalic acid method of Schatz. It is employed by Dr. Howard Kelly of Baltimore, and recent experimental evidence in its favour has been published in this country by Grimsdale. As practised by Howard Kelly the method is as follows: (1) Scrubbing for ten minutes with green soap and hot water frequently renewed; (2) immersion in a hot saturated solution of permanganate of potash until the hands and forearms are stained a deep mahogany brown; (3) immersion in a hot saturated solution of oxalic acid; (4) rinsing in sterilised lime-water to remove the excess of acid. Permanganate of potash is known to be a germicide of very feeble power, and it is difficult to believe that this method can offer the requisite assurance of safety. Leedham-Green has tested it, and found in 50 per cent of the cases experimented upon it left the hands strongly infected; similar results have been obtained by others.

The difficulty and uncertainty of properly sterilising the hands has led many surgeons to adopt the plan of operating always in rubber gloves. These can be sterilised by boiling, and kept afterwards in an antiseptic solution until required, when they can be fitted upon the previously sterilised hands without coming into contact with any unsterilised object. These gloves can now be obtained of good quality and so thin as to impede to only a slight extent the surgeon's tactile sense, and even this impediment can be greatly reduced by constant use. They offer, therefore, an additional safeguard; and if regarded strictly in that light there can be no objection to their use. But it must be remembered that they frequently become torn or pricked during an operation, and therefore their use does not relieve the surgeon of the obligation of practising the most rigid sterilisation of the hands; for if this stage be neglected and reliance placed upon the sterilised covering, disaster may follow any injury to the gloves during operation. Even if not employed as routine practice, the use of gloves is certainly to be strongly recommended in operations involving septic or otherwise infected tissues, in order to preserve the hands from that bacterial contamination which, as we have seen, so greatly increases the difficulty of sterilising them.

IV. Sterilisation of the Field of Operation.—The only parts with which this article is concerned are the abdominal wall, the vulva and perineum, the vaginal and cervical canals.

Abdominal Wall.—The bacterial flora of the skin of the abdominal wall do not differ notably from those of the hands, except that the risk of artificial contamination with pathogenic organisms is much less, and under ordinary circumstances may be said to be non-existent. In the pubic hair there is a certain amount of danger, for hairy localities are always more difficult to sterilise than those upon which little hair grows. The personal habits of the individual also count for a good deal, the skin of cleanly folk being much more easy to sterilise than that of the very poor or destitute, to whom personal cleanliness is unknown. Such conditions as eczema or furuncles, of course, greatly increase the numbers of bacteria in the affected parts, and in the case of the latter, at any rate, introduce the very organisms which the surgeon has most reason to dread. Sterilisation of such diseased areas of skin is practically impossible; and if operation must be undertaken notwithstanding, they should be sterilised as far as possible, and then covered up with an impermeable dressing, such as collodion. Suppurating sinuses can be scraped out, plugged with antiseptic gauze, and then sealed in the same manner.

The method usually employed with the abdominal wall is as follows:—The pubic hair is shaved down to the symphysis twenty-four hours before the operation; the skin is then mechanically cleansed by scrubbing with soap and hot water, then well swabbed first with ether and afterwards with alcoholic solution of corrosive sublimate or biniodide, and finally covered up with an antiseptic compress composed of two or three layers of lint soaked in 1-1000 perchloride or biniodide solution, which is not removed until the operation is about to be commenced. When the patient is under the anæsthetic the skin can again be swabbed, and special attention paid to the sterilisation of the umbilical folds, in which dirt is very apt to lurk unobserved. Many operators have the skin of the operation area sterilised by an assistant in this manner under anæsthesia immediately before the operation is begun, and do not employ any previous preparation.

Vulva and Perineum.—The healthy skin of this locality teems with very large numbers of organisms of the most varied kinds. In addition to the usual skin bacteria, it becomes contaminated with those of the intestinal canal, the vagina, and the urine. Pathogenic organisms are therefore very frequently met with, including streptococci and staphylococci; and in morbid conditions of these parts many other kinds are doubtless present. Menge and Krönig have given some attention to this subject, and they find that the ostium vaginæ, including the urethra and the ducts of Bartholin's glands, differs notably in its bacterial flora from the vulva outside it. The organisms found are those of the vaginal canal, not those of the vulva and perineum, and are mostly anaerobic saprophytes. In seventy observations they found the ostium vaginæ sterile in four, and pathogenic organisms were met with only in five of the seventy observations. It is worth while, therefore, to bear in mind that operations upon the labia and perineum involve skin which is usually contaminated, while operations upon parts within the vulva do not.

But while the sterilisation of the parts preparatory to such an operation as perineorrhaphy, or the excision of a cyst of Bartholin's gland, is necessarily extremely difficult, the matter should not, therefore, be neglected; for a diminution in the numbers of bacteria present is, as we have seen, a distinct surgical advantage, since the effects of bacterial contamination are to some extent, at any rate, dependent upon quantity. The method employed must be practically the same as that used for the abdominal wall: shaving, swabbing with soap and hot water, then with an aqueous solution of perchloride or biniodide of mercury, followed by an antiseptic compress. The aperient is best given on the morning of the day preceding the operation, and an enema a few hours before the operation; after the enema the soaping and swabbing must be repeated, and the parts again covered up. The catheter can be used immediately before the patient is anæsthetised. Careful preparation of this kind certainly promotes the prompt and healthy union of perineal wounds, even if it fail to render the skin aseptic.

It must also be borne in mind that pathological conditions of the vaginal secretion form, perhaps, an even more serious obstacle to the healing of perineal wounds than contamination of the skin; for the vaginal discharge, flowing over the surface of the wound, is certain to infect it. Sterilisation of the vaginal canal may therefore become a necessary part of the preparation for a perineal operation.

Vaginal and Cervical Canals.—Observations upon the bacterial flora of the normal vaginal and uterine secretions have hitherto yielded somewhat contradictory results; the conclusions of Menge and Krönig can, perhaps, be accepted as the most trustworthy.

(*a*) *Vaginal secretion.*—These authors have found that the vaginal secretion of the new-born child is sterile and faintly acid in reaction; after a few days of life it becomes more distinctly acid, and contains the bacillus vaginalis of Döderlein. As is well known, this organism is the normal inhabitant of the vaginal canal, and confers upon the secretion distinct bactericidal properties which serve to prevent the development of most other kinds of organisms which may obtain accidental access to the vagina. In the adult virgin woman the secretion of the vagina has the same characters as that of the infant a few days after birth. Under normal conditions, it is only after sexual congress that the characters of the secretion become notably changed. It then usually contains a varied bacterial flora, its reaction may be strongly acid, faintly acid, or even alkaline; it frequently contains saprophytic and occasionally pyogenic organisms. During pregnancy it is noticed that the characters of the secretion revert more closely to those present in infancy, the bacillus vaginalis becoming much more abundant. After the climacteric period the secretion is notably altered; its reaction becomes alkaline, and it contains large numbers of saprophytic organisms, while the vaginal bacillus disappears.

(*b*) *Uterine secretion.*—Menge and Krönig regard the external os uteri as forming the limit between the bacteria-containing and the bacteria-free portions of the genital canal. Under normal conditions they believe that no organisms are to be found either in the secretions or in the mucous membranes of either the cervix or the uterus. They attribute to the cervical secretion definite bactericidal properties, and consider that it protects the body of the uterus from bacterial invasion from below. The only organisms they have found growing in the uterine mucous membrane are the gonococcus and the tubercle bacillus. But if the uterine cavity contains dead tissue, a varied pathogenic flora may be found in it.

If these data are reliable, it is clear that sterilisation of the vagina and cervix will prove to be an easy or a difficult task in accordance with the local conditions which may be met with. An inflamed condition of the vaginal wall induces changes in the vaginal secretion, and purulent or muco-purulent discharges may always be regarded as evidence of bacterial contamination. If under such conditions the posterior fornix is opened either in colpotomy or hysterectomy, abdominal or vaginal, considerable risk of peritoneal infection must be faced, and preliminary sterilisation should be carefully practised. But except under the conditions just named such operations as colporrhaphy and curetting require very little previous vaginal sterilisation. If operations are undertaken where vaginitis is present, then careful douching, followed by tamponement with iodoform or bicyanide gauze, should be practised for two or three days previously, and the vaginal walls finally swabbed thoroughly with an antiseptic solution such as lysol (ʒi. to Oi.) under the anæsthetic.[1]

The parts surrounding the field of operation should be covered up as far as possible during the operation to avoid the loss of body heat caused by exposure. The clothes and other coverings must in turn be covered up with towels, either dry and sterilised or soaked in an antiseptic lotion; in the latter case mackintosh sheets must be laid between them and the clothing to protect the body of the patient from damp. In an abdominal operation this is all comparatively simple; in a vaginal operation the modified lithotomy position renders it more difficult. But sterilised towels can be fastened over the legs, so as to completely cover the legs, the bar and loops of the crutch, and the blankets covering the abdomen. Without this precaution it is impossible to avoid touching the unprotected legs of the patient during the operation.

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[1] The exceptional risks which attend intra-uterine operations when gonorrhœal infection is present have been referred to on p. 573.

Intestinal disinfection.—Some attempts have been made of late to introduce the practice of administering certain drugs believed to act as intestinal antiseptics for a few days before performing an abdominal operation, on the ground that in this way the numbers of the bacillus coli communis may be reduced and the risks of subsequent infection from this organism diminished. The drugs employed for this purpose are β Naphthol, Salol, Cyllin, and other coal-tar products, but direct evidence of the advantage of this proceeding is naturally difficult to obtain, and up to the present has never been advanced.

V. The Protection of the Wound.—During an operation the utmost care is required to preserve intact the sterilised condition of the numerous articles which come directly or indirectly in contact with the wound. The surgeon must not only be on guard himself against breaches of asepsis, but he must spare time from his work to see that his assistants do the same. Practice alone can teach the habit of working under strict aseptic principles, and it must be said that many surgeons at the present time do not think it worth while to maintain in all its strictness the stern discipline of asepsis. They are satisfied with the results they obtain by partial compliance with aseptic rules, and regard such evidences of failure as a stitch abscess or an imperfectly united wound as a trivial matter. But if our aim is high our achievements are likely to be better than if we were content with a lower aim, and an uninterrupted convalescence from a surgical operation is an object worthy of the most careful attention, and even of infinite pains on the part of all concerned in surgical work.

The dressing of a laparotomy wound after operation is a point of some importance. An air-tight covering would, of course, be the best kind possible, and as in the case of this operation the incision is practically always through healthy tissues, all that is required is to prevent contamination of the previously sterilised wound during the healing process. Lockwood advises that a piece of silver-foil previously sterilised by boiling should be laid over the closed wound so as to fit it accurately; this forms a practically air-tight covering, but does not prevent the escape of serum from beneath it, if any should be formed in the wound. Outside this may be placed an ample covering of layers of sterilised or medicated dry gauze and wool, and the whole covered and fixed in position by a many-tailed flannel binder. Strips of adhesive plaster may also be used to fix the dressings, but the plaster should be sterilised before use by steaming. As most laparotomy wounds for pelvic operations extend nearly to the pubes, the difficulty of keeping the lower part of the wound covered will arise as soon as the patient is able to move her limbs or change her position. This difficulty can be obviated simply enough by affixing perineal bands to the back of the binder and bringing them forward over a vulval pad to the lower tails in front. This prevents the binder from riding up, and keeps the whole wound covered. If the silver-foil covering be also used, the protection afforded to the wound is ample, and no disturbance of it will be required until the superficial stitches are removed on the eighth to the tenth day. If the skin has been united with catgut, it may be left for fourteen days, and on pulling off the silver-foil the external portions of the catgut stitches come away with it, leaving a perfectly healed wound beneath.

If abdominal drainage has been employed after laparotomy, the coverings must be differently arranged. In this case they must be of antiseptic materials, so that the discharges can be impregnated with antiseptics as they soak through, to minimise the risks of contamination by atmospheric organisms. It is also best to employ in those cases what Lockwood calls an "outside dressing," composed of eight layers of antiseptic gauze covered with a piece of thin mackintosh; this distributes the discharges and prevents them from reaching the external air at all. Vaginal drainage through the posterior fornix is usually preferable in pelvic operations; it is mechanically more efficient and does not impair the healing of the abdominal incision (see p. 871). Abdominal dressings should be changed with antiseptic precautions as careful as for an operation; the hands being carefully sterilised, and all instruments previously boiled. Wounds of the perineum, vaginal walls, and portio vaginalis, although their complete protection is impracticable, usually heal readily.

T. W. Eden.

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T. W. E.

MINOR UTERINE OPERATIONS

I. DILATATION OF THE UTERUS.

THIS operation, introduced by Simpson in 1844, may be required for various purposes. Dilatation may be complete so as to admit the finger or a large instrument, or partial, to facilitate curetting or intra-uterine medication.

Complete dilatation is mainly effected for diagnosis by digital exploration, or for treatment of some condition otherwise diagnosed. It is most frequently employed for the purpose of discovering the cause of an intra-uterine hæmorrhage; and the dilatation must, for that object, be sufficient to admit the introduction of the little finger or, if need be, of the index finger of the operator. Partial dilatation is practised for the treatment of some cases of dysmenorrhœa and sterility; or as a preliminary to the application of some caustic or counter-irritant to the endometrium; or for the purpose of curetting in cases of hæmorrhage or chronic purulent endometritis, where the uterus is not much enlarged and digital exploration not needed. In all cases where a diagnosis cannot be made by the examination of portions of the endometrium detached by the curette or other instrument, or where polypus cannot be excluded by other evidences, it is wise to make sure of the nature of the case by dilating so as to admit the finger.

Dilatation should preferably be performed immediately after the cessation of a period when the cervix is soft and somewhat patent. This softness and relaxation may be greatly increased by the introduction of a glycerine tampon two hours beforehand by the nurse.

Methods of dilatation:—

A. Gradual dilatation: *a*. By antiseptic wool or gauze. *β*. By tents.

B. Rapid dilatation: *a*. By graduated bougies. *β*. By two- or three-bladed dilators.

C. Combined gradual and rapid methods.

D. Dilatation with incision.

A. **Gradual Dilatation**:—*a. By Antiseptic Wool or Gauze.*—This method was introduced by Vulliet in 1886, and is easy of execution; if antiseptics are rigorously used, and suitable cases selected, no danger should arise. The vagina and vulva should be previously rendered aseptic by douching and washing. The cervix should be exposed by a Sims' or by a bivalve speculum, and the anterior lip seized by a volsella and held steady at a somewhat lower level than normal. The cervix should then be cleansed, and the direction of the uterine canal ascertained by a sound; if the os internum be found to be small, a few graduated bougies may be passed. A strip of gauze, a quarter to one inch wide, is then dipped in carbolised or iodised glycerine, and introduced by doubling it over the end of a uterine gauze applicator. This instrument should taper somewhat towards the end, which should be blunt-pointed. Gauze may also be introduced on long, narrow-bladed forceps.

The gauze should be carried up to the fundus, the probe withdrawn, and more gauze similarly introduced, till the cavity is somewhat tightly packed. Vulliet preferred to dilate by wool tampons, varying in size from a pea to an almond, rendered antiseptic by dipping them in a 10 per cent ethereal solution of iodoform. Whether gauze or wool have been used, it should be withdrawn after twenty-four hours, and the cavity carefully cleansed with sublimate swabs. Fresh gauze is then similarly introduced, and, after the third introduction, the cervix will be so softened and dilated as to admit the finger. The advantage of this method is that it is nearly painless; its disadvantage is its slowness. To lessen any risk of septic absorption through lesions accidentally made, gauze should never be thus used if the uterine discharges be offensive.

If it be desired to keep the cervix patent after either rapid or slow dilatation, continuous packing of the uterus will ensure further dilatation, and render any subsequent manipulation easier. In some cases of chronic endometritis a partial dilatation and drainage by gauze, with the application of iodine liniment or paint twice weekly whilst drainage is continued, the patient meanwhile keeping to her room, will often cure the condition. Curetting is, however, in most cases preferable.

β. By Tents.—According to More Madden, sponge tents were invented by Phillip Barrow in 1539; but the method was so far forgotten that when Sir James Simpson revived their use, in 1844, he stated that "intra-uterine disease was generally considered beyond the pale of any certain means of detection or possibility of removal."

The tents now mostly used are laminaria (introduced by C. F. Sloan of Ayr in 1842) and tupelo. Laminaria tents, as sold by instrument-makers, are unreliable as regards antisepsis; and it would be worth while for any gynæcologist who uses them much to collect and prepare his own—an easy undertaking. Sponge tents are so difficult to get surgically clean that they should be altogether discarded. The use of tents not absolutely aseptic is most disastrous, and has caused many a death; in the pre-antiseptic days, acute metritis, salpingitis, peri- and para-metritis and septicæmia were frequent consequences. Laminaria tents should be kept in a 1 in 1000 solution of alcohol and corrosive sublimate.

Tents are now mainly used as a preparatory step to rapid dilatation; but they are still sometimes used alone for dilatation, and must then be repeatedly introduced till the finger can be inserted. Rapid dilatation answers almost all purposes, but, as it is evident that tents are still frequently used, full details of their introduction are here given.

After sterilisation of the tents and the vaginal canal the patient is put into the Sims or lithotomy position, and a duckbill speculum (Fig. 36) introduced; the cervix is then pulled down by a sharp hook, so as to fix the uterus and straighten its canal. The actual length and curve of the cavity is then ascertained by the sound, and the size of tent which can probably be introduced is roughly gauged. A laminaria tent can be curved by holding it over a spirit-lamp till hot. The cervix should then be cleansed with sublimate solution, and the tent passed either on a pointed introducer provided with a cannula, such as Routh's (Fig. 183), or held in a suitable pair of forceps, such as Chambers' (Fig. 184). It is a good plan to dip the tent into pure liquid carbolic acid before inserting it. As large a tent, or as many small ones as can be passed beyond the os internum, should be inserted at once. The ends should slightly project into the vagina. An antiseptic vaginal tampon should then be inserted. The tents should be left in from eight to twelve hours; the hollow laminaria ones do not readily dilate to their full extent at the os internum, where there is greatest resistance. To extract a tent, all that is necessary is to draw upon the string attached to the vaginal end; but if the tent has not dilated well at the level of the os internum, forceps must be used to pull and lever it out, whilst counter-pressure is exerted upon the cervix by the finger. To admit the exploring finger into the uterus, one or often two reapplications of the tents have to be made. Fresh tents should only be introduced after careful antiseptic cleansing both of the vagina and the uterine cavity.

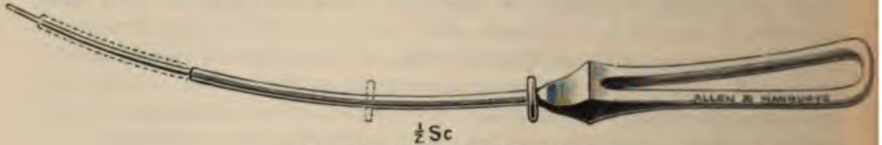

FIG. 183.—Routh's tent-introducer.

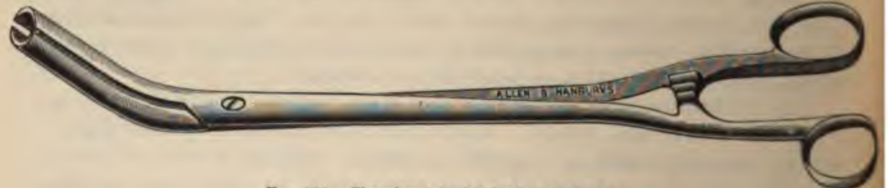

FIG. 184.—Chambers' tent-introducing forceps.

If only a slight further dilatation be necessary, and rapid dilatation be not available, a tupelo tent is better than another series of laminaria, as it dilates more rapidly and more evenly, can be obtained of larger size, and be more efficiently rendered antiseptic. By this time, especially if a third series of tents have been introduced, the temperature may have risen, the patient will be irritable and restless, and sometimes nauseated, and not in the best condition to undergo a prolonged examination for the purpose of treating whatever conditions may be found.

Tents should never be used if the uterine discharges are offensive, as the absorption of pent-up putrescent secretions may lead both to local septic inflammation and to general septicæmia; and, even recently, deaths have been described as having occurred under these conditions. I refer to such cases as cancer of the body of the uterus, sloughing polypus, and even to some cases of fungous endometritis in which the villous processes of gland tissue have either become ulcerated or have sloughed superficially. The same tent should never be used twice. After the withdrawal of tents some strong antiseptic should be carried up into the uterine cavity, such, for instance, as liquor iodi or iodised phenol; and drainage should be maintained for twenty-four hours, by passing up into the uterus a thin strip of iodoform gauze soaked in iodised glycerine.

Every now and again it is found that the effect of the introduction of a tent upon the nervous system is considerable; the patient becomes restless, or vomits incessantly, or the temperature rises either immediately, or too soon for it to have a septic origin; a few cases of convulsions have been described, and one or two of tetanus. In one case, treated by myself, the temperature rose to 107° F. within thirty minutes of the insertion of the tent; but under the influence of a hypodermic injection of morphia it gradually fell, and by the next morning, on removal of the tent, it was 99° F.; the patient recovered without further trouble.

B. **Rapid Dilatation.**—Dilatation by tents, except as a preliminary step, having now been almost universally given up, exploratory and therapeutical dilatations are performed either entirely, or in the main, by one or other of the rapid methods. Whereas it used to take from twenty-four to forty-eight hours to dilate the uterus sufficiently to admit the exploring finger, it is now done with far less risk in from fifteen to thirty minutes.

Indications for Rapid Dilatation.—Rapid dilatation may have to be done for the treatment of some forms of dysmenorrhœa, as a preliminary step to a thorough application of some medicament to the endometrium, or preparatory to curettage, or to the removal of an intra-uterine polypus. The main object of rapid dilatation, however, is to enable the finger to be introduced for the purpose of making a diagnosis of the intra-uterine condition in cases of uterine hæmorrhage where no constitutional cause or obvious local extra-uterine disease exists.

Assuming, then, that a woman comes for treatment, one of whose chief symptoms is menorrhagia or metrorrhagia, inquiries would be made as to any constitutional cause, and a vaginal examination would be made, unless contra-indicated by virginity or youth. In all cases of hæmorrhage after the menopause, or even in cases of severe hæmorrhage before that time of life, a vaginal examination should be insisted upon to make the diagnosis sure. Possibly some obvious cause of hæmorrhage would thus be discovered, such as cancer or adenoma of the cervix or vagina, adhesive ulcerative vaginitis, severe erosion of the vaginal portion of the cervix, ulceration from foreign bodies, an extruding fibroid, a cervical mucous polypus, ulcerating procidentia, or inversion of the uterus. The possibility of a molar pregnancy, a threatened, incomplete, or missed abortion, or the existence of a mole or an endometritis of the gravid uterus must not be overlooked.

Aids to Rapid Dilatation.—Many uteri are difficult to dilate sufficiently to admit the finger, and it is impossible to decide beforehand which cases will prove so. There are certain aids to dilatation, rendering it easier, quicker, and less dangerous, which it is desirable to emphasise. First of all, it is infinitely easier to dilate the cervix soon after a menstrual period has ceased than at any other time; the tissues are softer, and the cervix is somewhat patent. This was first noted by Dr. C. H. F. Routh in 1864; recently Dr. Braithwaite has drawn special attention to this point, and Dr. Herman has shown that this relaxation is most marked on the third or fourth days of the periods; but it is better to await the cessation of the period before attempting dilatation. Secondly, the cervical glands should be encouraged to secrete, for, as Dr. Champneys has said, dilatation is physiological, and the cervix has to be induced to yield; when it yields it also secretes, as in pregnancy and labour. When the cervix is moist it is dilatable; when dry it is rigid; and, in this latter condition, any attempt at rapid dilatation is generally a failure, and may cause extensive tearing. Many writers consider that the best way to overcome this rigidity is by preliminary partial dilatation by tents; but it is evident that there may be danger in this also, as well as several hours' discomfort to the patient.

The cervix can be induced to secrete freely by inserting into the vagina, two or three hours before the operation, a wool tampon soaked in glycerine, or—though this is less effectual—a gelatine and glycerine pessary. The effect of the glycerine is enhanced by the addition of a little cocaine, which serves to relax local spasm, just as in cases of "rigid cervix" in the first stage of labour. In either case the glycerine should be applied close up to the external os uteri. Secretion is further helped by giving a warm vaginal douche of boric acid or creolin before introducing the glycerine tampon.

If unusual difficulty be anticipated, owing to nulliparity, advanced age, or the presence of fibroids, additional help may be afforded by passing into the cervical cavity, and if possible through the os internum, some gauze saturated with glycerine and iodoform. This may be introduced from six to twelve hours before the operation. As has been stated, this preliminary gauze packing should not be adopted when there is an offensive discharge. These "aids" practically obviate the need for a preliminary dilatation by tents in all but very exceptional cases.

Methods of Rapid Dilatation.—Assuming, however, that rapid dilatation has been decided upon for the purpose of making a diagnosis of the intra-uterine condition, there are several ways by which this can be effected, viz.: (1) By graduated bougies; (2) By two- or three-bladed dilators, with or without attached screws.

(1) *Rapid Dilatation by Graduated Dilators.*—In England dilatation by this method is preferred; and when carefully and antiseptically conducted, it is free from risk, sufficiently speedy in its performance, and effectual in its results. Hegar's dilators were first introduced to the profession in 1881, but were not in general use in this country till eight or ten years later; when, amongst others, Drs. Lewers and Phillips drew special attention to their value. Hegar's original dilators were rather short, and made of polished wood or ebony; they consequently gave rise to a good deal of friction, and were if anything too sharply pointed. To overcome these disadvantages Hegar's dilators are now made about the same length as a male catheter, with a sharper curve than Hegar's, and are constructed of hollow metal with ends somewhat less pointed.

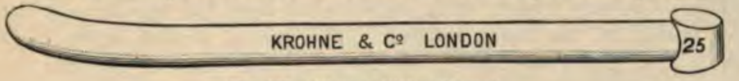

Fig. 185.—Uterine dilator (Hayes').

There are numerous varieties of metallic bougies, with varied details in the length, the shape of the point, the curve, the weight, and the handle. Those of Hayes (Fig. 185), Matthews Duncan (Fig. 186), or Fenton (Fig. 187) are probably the best, the last being the most portable.

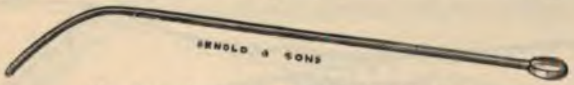

Fig. 186.—Uterine dilator (Matthews Duncan's).

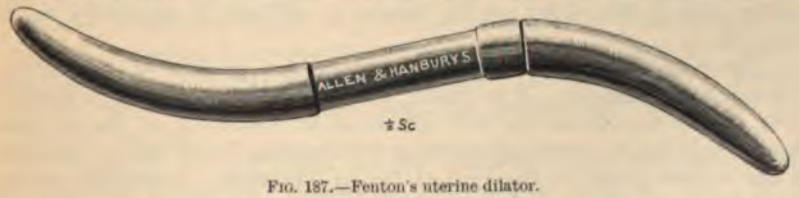

Fig. 187.—Fenton's uterine dilator.

The best size to begin with is one with a diameter of four millimetres, and each succeeding size should increase in diameter not more than one millimetre. They should be numbered according to their diameters. A case is occasionally met with where one millimetre seems too large a difference; and it is therefore advisable for hospital use to have some made with a half-millimetre difference. In private, the difficulty is overcome by giving more time, or by having always ready a Goodell's two-bladed parallel dilator (Fig. 191), which will speedily overcome the resistance, so that the next size may be used. Metal dilators involve very little friction, follow the pelvic and uterine curves more easily, and, owing to their greater length, allow greater facility of manipulation. Their points being less tapering, they also dilate the uterus right up to the fundus. With these instruments the usual time taken to dilate the uterus so as to admit the finger is about fifteen or twenty minutes.

The Operation.—The patient having been duly prepared by previous purgation, the vagina having been douched, and all antiseptic precautions taken, the patient is anæsthetised, and placed either in the lithotomy position—Clover's crutch being employed to keep the legs up—or else, as some prefer, in the Sims position. The vagina is then again cleansed with a 1 in 2000 sublimate solution, and the anterior lip (the uterus being assumed to be anteverted) is seized with a volsella forceps, drawn downwards, and held steady. This straightens the uterine curve, and prevents the strain on the ligaments which must occur if the bougies are passed without the uterus being thus fixed. A uterine sound is next introduced to ascertain the exact curve and length of the uterine cavity when thus drawn down; and then the smallest-sized bougie is steadily passed. It is important to use a volsella forceps which will not readily tear or cut its way out, and for this reason Teale's forceps (Fig. 188), which has several blunt teeth on each face, is the best, as it seizes the anterior lip bodily, and if the racket on its handle is efficient, it practically never slips off.

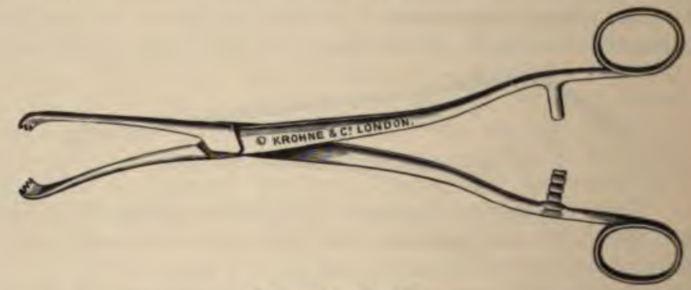

FIG. 188.—Teale's forceps.

The time which should elapse between the passage of succeeding dilators varies greatly. If a dilator has been introduced with difficulty, time should be allowed for it to get loose by relaxation of the cervical fibres; this can be tested by partially withdrawing it and feeling whether it has become looser in the grip of the os internum. Sometimes one to three minutes may be needed for this relaxation to occur, but as a rule a few seconds suffice. An assistant should remove the dilators, when the operator has ascertained that they are ready for removal, thus enabling the latter to have in his hand the next-sized bougie ready for immediate insertion. This is an important detail, as the spasmodic contraction of the cervix during the first ten minutes is remarkably persistent even under deep anæsthesia, the pelvic reflexes not being annulled till after the conjunctival reflexes.

The extent of the dilatation required will vary according to the nature of the case. If a digital exploration be required, it is usually sufficient to dilate so as to admit the little finger, especially if the cervix can be drawn well down. This may enable the operator to diagnose a polypus, malignant disease, or fungous endometritis; but he must not be satisfied till he has succeeded in feeling, if possible, the whole of the uterine wall, including the two cornua, which are favourite spots for placental polypi and hypertrophic endometritis. The finger can explore uteri which are considerably longer than the examining finger if the other hand be used above the pubes to press down the fundus, care being taken that the bladder is empty. If malignant disease be diagnosed, no further dilatation is required; or if the diagnosis be uncertain, the curette or scissors will be wanted to remove a piece for microscopical examination. If a fibroid polypus be found, further dilatation may be needed to admit the scissors or forceps along the finger. If fungous endometritis be detected, a curette can be at once used. If a bit of placenta be found, it may usually be detached by the finger-tip. Sometimes after the passage of a few dilators the diagnosis of fungous endometritis is made, by pieces of characteristic material coming away; but it is only safe to accept this as being the sole condition in small uteri, as it is not unusual to find this state of the endometrium complicating both polypus and submucous fibroid.

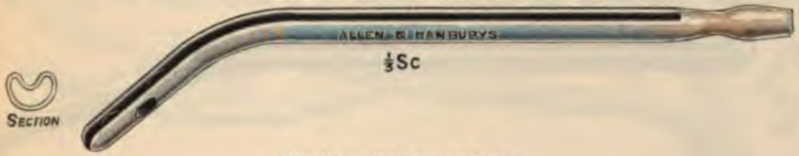

FIG. 189.—Budin's glass tube.

It is evident that the amount of dilatation for exploratory purposes really depends upon the size of the operator's finger, or rather upon the size of the second joint of that digit; and this is a matter of considerable moment, as fingers vary several millimetres in diameter, and any risk to the patient is necessarily proportional to the amount of dilatation required. It is for this reason that diagnosis should be made if possible by the little finger. Usually the fingers of the left hand are smaller than those of the right.

Whatever be the object of the dilatation, and whatever be the subsequent procedure (curetting, removal of polypus, etc.), it is advisable to apply to the endometrium some strong antiseptic, such as liquor iodi or iodised phenol, on a Playfair's probe, which should be covered with as much wool as will easily enter the dilated cervix. To permit free drainage, and prevent uterine colic following the application of the iodine, a piece of iodoform gauze should be passed up to the fundus in the manner previously described, and should not be removed till next morning, after which the vagina will also be douched. Some operators prefer not to apply any antiseptic after dilatation unless purulent endometritis is present, or the discharge indicates the existence of a septic intra-uterine condition. It is advisable, however, if this be not done, and if a flushing curette be not subsequently used, to wash out the uterus thoroughly with iodised or carbolised water at a temperature of about 118° F., by means of a double-channelled glass tube, such as Budin's (Fig. 189), or Graily Hewitt's (Fig. 190).

The Dangers of Rapid Dilatation.—The risk of rapid dilatation is very small if carried out thus. There is hardly ever any subsequent pyrexia except in cases of malignant disease, when it probably arises from septic absorption. In cases of tubal disease there is sometimes a little inflammatory reaction, but if free drainage be provided this soon passes off; slight chronic salpingitis, which existed as a sequence to the concurrent endometritis, often disappears within a few weeks. Such pelvic swellings as congested ovaries or swollen tubes are not necessarily contra-indications to rapid dilatation, for slow dilatation by tents would be more risky.

If perforation of the uterus should occur by some accident—such as roughness on the part of the operator—or, as more often happens, from extreme softness of the uterine tissues, as in some cases of early subinvolution, or from friability of the tissues, as in carcinoma, serious results will not follow, provided that antisepsis has been thorough and the accident is immediately recognised. The proper treatment in such cases is to cease further dilatation, and after cleansing the vagina and cervix, lightly to pack the uterine cavity with gauze. In a few hours lymph will have covered the perforation, and probably no symptoms beyond some sickness will ensue. All cases of perforation do not terminate thus satisfactorily; but these are either in themselves septic, or antiseptics have been neglected, or the accident has not been recognised, and more bougies have been passed, possibly even a curette used, and the bowel injured. Fortunately such accidents are very rare, but the possibility of the uterine tissue being extremely soft must be kept in mind. If it be recognised that the perforation through the uterus is extensive, or the uterine contents are septic, or the bowel has come down into the uterine cavity, the abdomen should be opened, and if the rent cannot be sutured, hysterectomy should be performed; some operators would prefer to perform vaginal hysterectomy, being particularly careful to ensure subsequent good drainage by gauze.

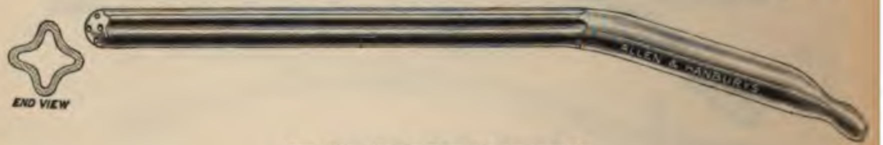

FIG. 190.—Graily Hewitt's uterine tube.

If the cervix be rigid, slight lacerations of the mucous membrane usually occur, and occasionally when the exploring finger is introduced rather deep splits are found, usually on the left side; but in a series of several hundred cases I have never seen inflammatory troubles follow or permanent mischief result. Such tears seem to commence at the level of the os internum, and may be suspected if a dilator pass easily after the preceding smaller size entered with difficulty.

Occasionally hæmorrhage suddenly arises during a dilatation, as for instance when a piece of placental polypus becomes detached, appearing, it may be, at the os externum when the bougie is withdrawn. In such a case the hæmorrhage is sometimes alarming, and it may not be safe to attempt further dilatation with a view to explore with the finger; but it will always be wise to pass in the curette and rapidly scrape the endometrium to remove any remaining placental tissue, and thus encourage retraction. If the hæmorrhage persist, as it probably will, the uterus should be plugged at once with antiseptic gauze, and the plugs retained *in utero* for twenty-four hours, by which time the uterus will be sufficiently dilated to admit the finger if necessary. The hæmorrhage appears to be arrested by pressure and by the blood coagulating readily upon the gauze, and not by the presence of a foreign body exciting the uterus to contract.

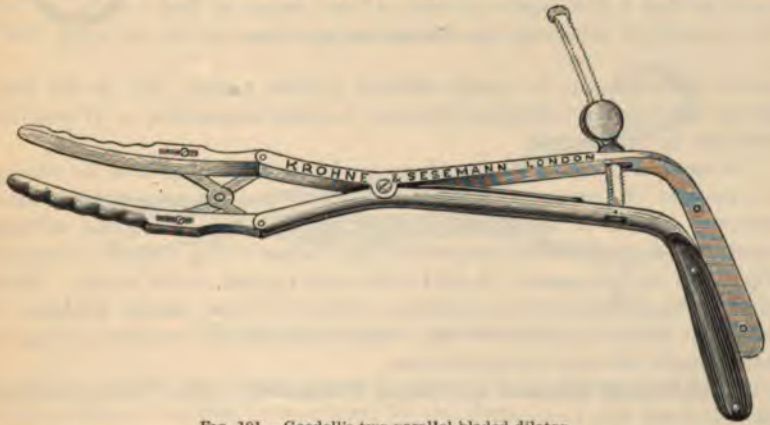

FIG. 191.—Goodell's two parallel-bladed dilator.

(2) *Rapid Dilatation by Two- or Three-Bladed Dilators.*—This type of dilator is preferred by some, but none of these instruments has met with universal approval, owing to the irregular way in which they dilate, the time occupied by the process, the frequent failures, and the greater tendency to tearing of the cervix. There is, however, a great advantage in having one of these instruments at hand when using graduated dilators, as it occasionally happens that the operator finds it difficult to pass the next bougie, or possibly a particular one may have been forgotten. The possession of a dilator like Goodell's (Fig. 191) is then most opportune. For the employment of this instrument the cervix should be somewhat patent; and if it be found that it cannot enter the cervix above the os internum, a smaller-sized dilator, such as Palmer's two-bladed dilator (Fig. 192), should be first used, or a few graduated dilators passed. The most

important precaution in using these instruments is to avoid opening the blades in one diameter of the cervix only. They should be opened very gradually in the transverse diameter first, then unscrewed and rotated, and again opened in another diameter, and so on till distension of the muscle has been uniformly effected all round. In a soft, relaxed cervix dilatation can be easily effected by this means; but in the nulliparous rigid cervix complete dilatation is often impossible, or if possible, attended by serious risk.

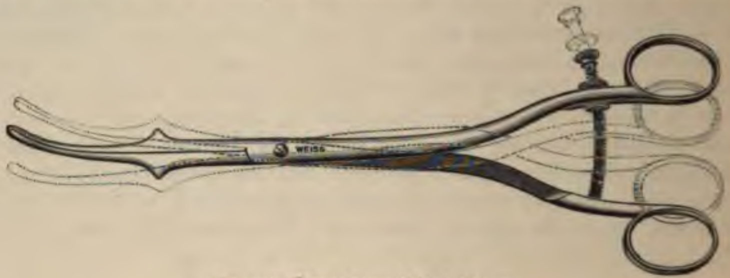

FIG. 192—Palmer's two-bladed dilator.

In cases of dysmenorrhœa, where moderate stretching is to be effected as a method of treatment, dilatation by these instruments is fairly satisfactory; and if it be desired to attempt a partial dilatation without anæsthesia, a small-bladed instrument like Palmer's (Fig. 192) or Priestley's (Fig. 193) may be passed in, and a few turns given to the screw. Much relief to the dysmenorrhœa sometimes follows if the partial dilatation is done just before a period is due. Great care should be taken as regards antiseptics in all such manipulations.

C. **Combined Gradual and Rapid Dilatation.**—After failing to dilate the cervix to the required size by rapid dilatation, it is not safe to continue the dilatation with tents until the abrasions have healed. The mucous membrane is necessarily torn here and there after such a trial, and septic absorption is very prone to occur. In such a case the best plan is to sterilise the endometrium thoroughly, and then to pack the cavity gently but firmly with 10 per cent iodoform gauze. This will efficiently dilate the uterus in twenty-four hours without any appreciable risk.

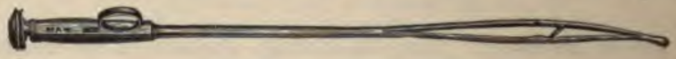

FIG. 193.—Dilator (Priestley's).

In nulliparous women, it is the routine custom of some operators to dilate the cervix partially overnight by means of tents (preferably laminaria) previous to rapid dilatation. This undoubtedly softens and begins to dilate the cervix, but is rarely necessary; it usually gives the patient a very uncomfortable night; and if the aids to rapid dilatation described on page 788 be made use of, this preliminary dilatation can be dispensed with.

D. **Dilatation with Incision.**—Occasionally the os uteri externum remains rigid, while the rest of the cervix becomes relaxed and dilatable; it may then be necessary to divide the rigid rim bilaterally. A common instance of this is where an intra-uterine polypus has been partly extruded, and has fully dilated the whole cervix, except a rim of rigid tissue at the os externum. Here a slight notch on each side causes the loss of a little blood; and the rigidity yields, affording sufficient space for dilatation to be proceeded with.

Incisions for this purpose, and for the division of the os externum in cases of pinhole os and conical cervix, may need to be somewhat more than mere notches. Then Küchenmeister's scissors (Fig. 194) should be used instead of ordinary scissors or bistouries. This scissors has a probe-pointed blade which is passed into the cervical canal, and a hooked blade which grips the cervix on its vaginal aspect and prevents it slipping, and so dispenses with the use of sharp hook or volsella forceps. The extent of the desired incision is regulated by the distance of the hooked blade from the external os uteri, as this blade is the cutting one. In all cases where a mere temporary dilatation is needed, the incision should be sewn up at once with silkworm gut. Incision by means of a Paquelin's cautery, or the galvanic cautery with the platinum terminals brought to a dull red heat, is very efficacious in preventing hæmorrhage; and it may advantageously be used when it is desired to prevent rapid reunion of the incised cervix, as, for instance, when the os uteri externum has been divided for pinhole os. The cautery, however, should never be used to incise the internal os uteri near to which the branches of the uterine artery may be found, as, even if it prevent hæmorrhage at the time, secondary hæmorrhage is very likely to occur; and further, perfect asepsis at that level is very difficult to maintain. If it be desired to prevent closure of the incision, and the cautery has not been employed, the raw surfaces should be touched with liquor iodi; and a piece of gauze, soaked in iodised glycerine, and changed daily, should be kept in the cervix for some days, beyond the upper limit of the cut, and a vaginal douche given at the intervals.

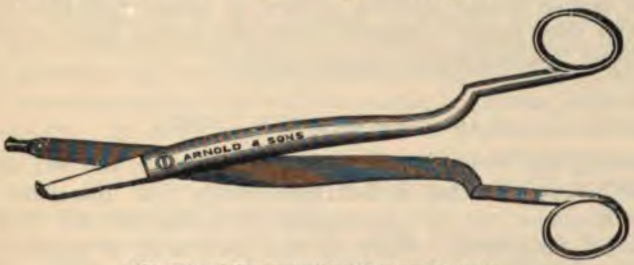

Fig. 194.—Scissors, uterine (Küchenmeister's).

If hæmorrhage be severe, it may usually be arrested by plugging the cervical cavity with gauze; or the bleeding point may be touched with the actual cautery, though, as has just been stated, this has its disadvantages. If this do not arrest the bleeding, the uterine artery, or the branch going to the cervix, must be tied or under-pinned.

In cases where the cervix cannot be dilated and digital exploration is essential, or where more room is needed than can be afforded by a complete dilatation, it may be necessary to incise the cervix freely. This is best done anteriorly. A curved incision should be first made on the anterior surface of the cervix, and the bladder then stripped off from the front wall of the uterus. The sides of the cervix should then be seized with two pairs of Muzeux forceps, and the anterior wall of the cervix and body of the uterus should be divided longitudinally by a strong pair of scissors. Free access is then obtained to the cavity of the uterus, and a submucous fibroid could, for instance, be easily enucleated. The uterine wall is then united by silk sutures, the bladder allowed to resume its position, and the vaginal wound sutured. There is usually very little bleeding, but if this were severe a ligature round the uterine artery at the bases of the broad ligament would at once arrest it.

II. Curetting the Uterus.

Curetting was introduced by Récamier in 1843, and was at first so vehemently opposed that it fell immediately into disrepute, though in 1850 Récamier was still advocating his curette for the "removal of intra-uterine fungosities," which he had discovered to be the frequent cause of obstinate metrorrhagia. In 1846 Sir Charles Locock described his scoop for the removal of malignant nodules, and soon afterwards Simon's scoop was also introduced. In 1861 Dr. C. H. F. Routh somewhat modified Récamier's curette, and read a paper to the Obstetrical Society of London, giving three cases of metrorrhagia cured by its use after a diagnosis had been made by slow dilatation and digital exploration. In 1866 Sims introduced his sharp curette with a flexible handle. This continued to be the favourite curette till about 1874, when Thomas introduced, and Mundé strongly advocated, a dull curette of flexible copper wire, and this was used almost universally in America for some years. In the same year Hegar, Kaltenbach, and Olshausen brought the use of the curette prominently into notice in Germany; and Trousseau,

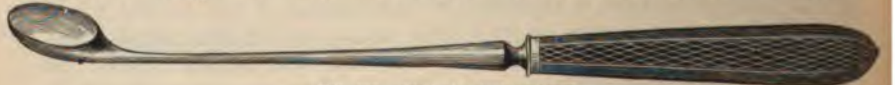

Fig. 195.—Simon's uterine scoop.

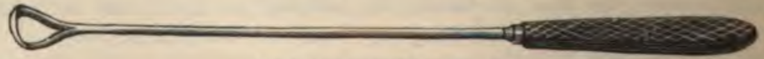

Fig. 196.—Sims' pliable curette.

Nélaton (1861), Maisonneuve, and Nonat (1869) occasionally made use of it in France. In England it was late in coming into favour, for in spite of its occasional use, as stated above, it was opposed at first by such authorities as Barnes and Atthill, though in 1873 the former, and somewhat later the latter, advised its use in serious cases. In spite of the recommendation of many strong advocates, it is probable that curetting would never have become so universally employed as it is now, if the era of antiseptics and of anæsthetics had not made it both safe and easy of execution.

Indications for Curetting.—This operation may be used merely to make a diagnosis of the state of the endometrium, by scraping off a small piece of the mucosa for microscopic examination. For such a purpose a small exploratory curette can be used without previous dilatation. Curetting is also done both for hypertrophic and atrophic endometritis, and for cases of septic or infective endometritis, with their resulting purulent discharges, in order to prevent tubal and periuterine complications from extension of the inflammation. Even if the periuterine tissues be already involved, it is good practice to remove the infective focus *in utero* by an efficient curetting; and if it be considered necessary to open the abdomen and deal with some serious condition there which has followed the endometritis, it is right to curette the uterus beforehand or simultaneously. In many cases the periuterine exudation will disappear after a careful curetting and packing of the uterus with gauze to ensure free drainage; and unless an abdominal section be clearly necessary this minor operation should be first tried.

Sometimes an endometritis exists with hæmorrhage as its chief symptom. This is usually hypertrophic and adenomatous in nature. For this state also curetting is indicated. Curetting is rarely desirable for the removal of placental or membranous débris retained after labour or abortion. If done at all it should be with a blunt curette, for the uterus may be very soft; in such cases the cervix is generally so patent, or so easily dilated, that the insertion of the finger involves no difficulty, and the piece of retained placenta or other matter can almost certainly be removed by the finger-tip alone, or by ring forceps guided by the finger.

Varieties of Curettes.—Curettes should be provided with some arrangement of the handle or shaft to prevent rotation, and to enable the operator to know which is the sharp and which the blunt edge. Some curettes have a sharp loop at one end, and a blunt at the other; and as these loops are on opposite faces of the shaft, the outside end gives sufficient indication of the direction of the intra-uterine end. Some curettes have loops of different sizes or curves at the two ends. Amongst such is that used at St. Bartholomew's Hospital (Fig. 197). It is desirable to have at least one end sharpened for deep curetting. For scraping away the friable tissues of a malignant growth—as a palliative measure, or preparatory to a radical operation—Volkmann's spoon or Thomas's uterine scoops are better than ordinary curettes. Flushing curettes—that is, curettes with the shaft hollowed out from the end of the handle to the space within the loop of the scraping end—are very useful. The best types are those of Auvard (Fig. 198), Donato, or Routh (Fig. 199).

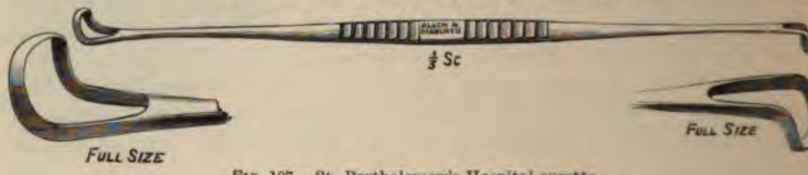

FIG. 197.—St. Bartholomew's Hospital curette.

The Operation.—It may be assumed that dilatation has been performed, that sufficient exploration of the uterus, by exploratory scraping or insertion of the finger, has been made, and that curetting is indicated.

The patient should be in the lithotomy position, both to facilitate the operation and to permit a perfect irrigation. The cervix is steadied and lowered as in rapid dilatation, and the largest-sized curette which will readily enter is passed up to the fundus, and then withdrawn with the sharp edge against the mucosa. This is repeated all over the intra-uterine surface. Special care is taken at the two cornua, as clumps of hypertrophic tissue are apt to be found there; to get at them it may be necessary to use a smaller curette, or one with the end set at a different angle. The cervix also should be subsequently curetted. Pressure with the sharp end should be firm and equal in curetting; and in going over the surface again to make sure (if possible) that all of the mucosa has been removed, it will be noted that if the curette cause a grating feeling or sound, it indicates that the mucosa has already been removed; but if no such sensation is produced, the lining membrane is still intact at that spot and needs further attention. To bring different portions of the mucosa, *e.g.* in the cornua, within reach of the curette, manual pressure may be made upon the uterus from the abdomen.

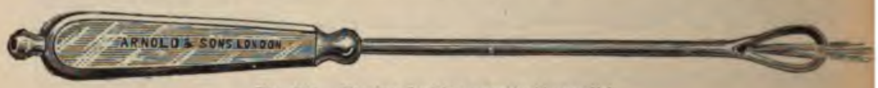

FIG. 198.—Uterine flushing curette (Auvard's).

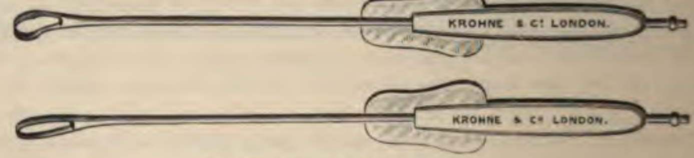

FIG. 199.—Routh's flushing curette.

The uterus should then be washed out with an antiseptic douche at about 118° F., if no flushing curette has been used, and its raw surface painted over freely with liquor iodi. In cases of septic or infective endometritis, the uterus should then be packed with iodoform gauze to encourage free drainage; if further intra-uterine treatment be indicated, the gauze should be removed and replaced in twelve hours, and the uterus kept patent. If there should be severe hæmorrhage the packing should be done more tightly, with a firm vaginal tampon below. In the latter case the uterine tampon may be left in for twenty-four hours. In most cases antiseptic douches are advisable for the first week, after which time the patient may get up, and in a fortnight resume her ordinary duties.

III. Removal of Polypi

Mucous Polypi.—These are usually found protruding from the external os uteri, or lying half hidden in the distended cervical canal. After antiseptic preparation of the vagina such polypi, rarely larger than almonds, may be removed by being seized in ring forceps and slowly twisted off. The cervix may then be carefully cleansed, touched with iodised phenol, and lightly packed with gauze. If hæmorrhage results, as it certainly would if the polypus had been incautiously snipped off with scissors, the cervix must be packed with gauze, or the stump of the pedicle touched with the cautery. If the body of the uterus be enlarged the cervix should be dilated and the uterus digitally explored, as other polypi may be present or even malignant disease of the body of the uterus. The polypus should be preserved for microscopical examination.

Fibroid Polypi.—If the pedicle can be reached, whether attached to cervix or body, it may be cut through with strong scissors, care being taken not to employ traction on the polypus lest uterine inversion should be produced. If spontaneous inversion is diagnosed, the covering of the fibroid should be incised and the growth enucleated. Hæmorrhage from the stump of the pedicle is rare owing to retraction of its muscular tissue. After removal of the polypus the uterus should be digitally explored, as "fungous endometritis" may co-exist and curetting be found necessary. In some cases where the pedicle cannot be reached owing to the size of the fibroid, it will be necessary to remove the fibroid polypus by *morcellement* with volsella and scissors until the pedicle can be reached.

The old method of passing up the wire-snare of an écraseur and cutting through the pedicle is unnecessary, as when the polypus is large the *morcellement* method would still be required for extraction after the pedicle was cut through. When the fibroid is thus reduced in size the pedicle can be reached and divided by scissors. When the operation is finished the uterus should be antiseptically irrigated, and its cervix lightly packed with iodoform gauze for twenty-four hours. The gauze is then removed, and daily vaginal douching is ordered for a week.

IV. VAGINAL ENUCLEATION OF FIBROIDS

If a sessile fibroid be present at the os uteri, or be found to bulge into the uterine cavity after the cervix has been dilated, it may be necessary to enucleate it from its bed of uterine muscle. To do this the covering of mucous membrane and capsule should be freely incised and stripped off by the finger-tips, raspatory, or other instrument. The fibroid itself should then be firmly seized in a strong volsella and twisted in all directions, the fingers of the other hand assisting to disembed it. If no larger than a small hen's egg, it can be drawn through the dilated cervix. If larger, it must be removed by *morcellement*. If larger than a fist, especially in a nullipara, it should be dealt with by abdominal section.

The dangers of enucleation are hæmorrhage, sepsis, and perforation of the uterus. *Hæmorrhage* is most marked after the enucleation of cervical fibroids, especially if they tend to burrow outwards into the base of the broad ligament, where capsular branches of the uterine artery would be very numerous. In such cases, if packing tightly with gauze does not stop the bleeding, ligature of the uterine artery on one or both sides would be necessary. *Sepsis* can be prevented by rigid antiseptics, by packing the cavity left after the enucleation, and subsequent antiseptic douching, provided no partially detached portion of the fibroid is left in the wound. *Perforation of the uterus* may be avoided by appreciating the possibility of a partial inversion of that organ, and by avoiding undue traction on the fibroid during its detachment.

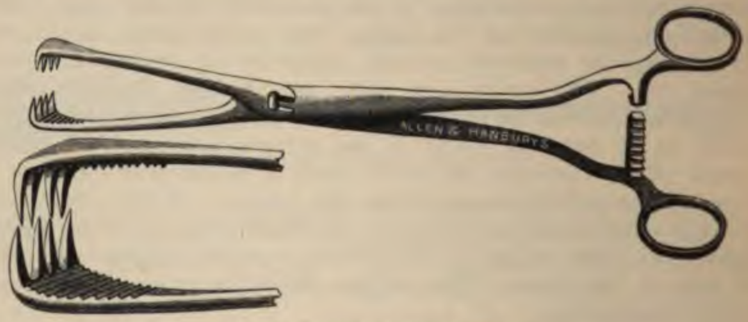

FIG. 200.—Strong volsellum forceps.

Removal of Fibroids by Morcellement after Enucleation.—Sometimes the fibroid, whether polypoid or submucous, is known to be large, or after partial enucleation it is found to be larger than was anticipated, so that it cannot be removed entire. In some cases room for extraction may be made by a bilateral incision of the exernal os, or by a longitudinal incision through the anterior wall of the uterus (see p. 796), and if necessary by free lateral incisions at the vulvar orifice. It is, however, as a rule better practice to remove the fibroid by cutting it up into fragments by what is known as *morcellement*. Briefly, this method is to seize the fibroid, or all the fibroids seriatim, by very strong volsella, after freely incising their capsules, and with a stout pair of scissors to cut round the forceps in a serpentine manner, or otherwise, as the shape of the fibroid indicates. Wedges of various sizes may be thus removed until the whole fibroid is disposed of. Hæmorrhage is very slight, owing partly to the traction employed, and partly to the retraction of the muscle tissue in the fibroid. Sometimes a sharp-pointed, sickle-shaped hook can be inserted into the fibroid and drawn forcibly but carefully downwards, as an aid to cutting it up into wedges (Fig. 201).

After all fibroids have been thus removed the uterine cavity should be examined, and any shreds of capsule or fibroid tissue removed by scissors. The uterine cavity should then be freely irrigated with iodised water, and packed with iodoform gauze for twenty-four hours.

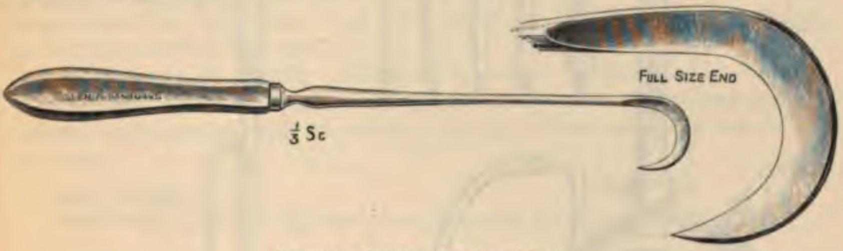

FIG. 201.—Kelly's sickel-shaped hook.

V. ATMOCAUSIS

Vaporisation of the uterus can be employed in two ways. In one, named atmocausis, the steam is permitted to act directly upon the interior of the uterus; in the other, named zestocausis, the steam is used to heat a hollow intra-uterine probe. The latter has no advantage over probes heated by electricity. According to Blacker, the modern revival of vaporisation of the uterus is due to Professor Sneguireff of Moscow (1894), who introduced it mainly as a hæmostatic. The precise indications for the operation, and many important modifications, have been since then introduced by Ludwig Pincus of Danzig. The steam is conveyed from the boiler (see Fig. 202) to the double-channelled intra-uterine tube by a thick india-rubber tube. The returning steam is carried off from the intra-uterine tube by a second rubber tube.

Although atmocausis can be performed without anæsthesia, as the pain caused is slight, it is desirable that an anæsthetic should be administered to the full surgical degree to prevent sudden movement. The patient should be confined to bed for forty-eight hours after its use. Full dilatation of the cervix to admit the finger is required before atmocausis, and if the endometrium is much thickened, curettage should be performed before the steam is turned on. This dilatation may either be done by the slow or the rapid method, according to circumstances. The operation itself is simple. The patient is prepared exactly as for curetting, anæsthetised, and placed in the lithotomy position; the uterus is then drawn down by a volsella, and the cervix dilated to admit the finger. The condition of the lining membrane of the uterus

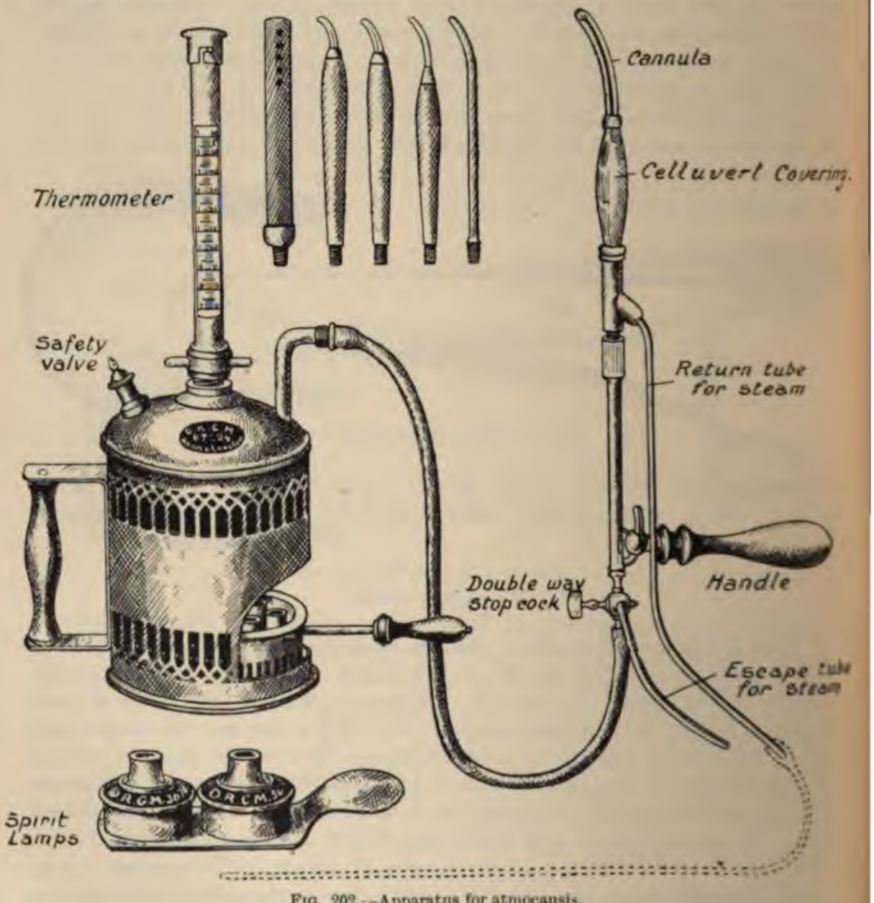

Fig. 202.—Apparatus for atmocausis.

is then noted, and, if necessary, curettage should be performed. The length of the uterine cavity is carefully measured by a sound, in order that the right length of cannula may be selected. Having seen that the apparatus is working properly, and that the steam has free access, introduce a Sims' speculum, and pass the cannula into the uterus just short of the full length, and allow the steam to pass in for from fifteen to thirty seconds only. The uterus and vagina are then gently packed with iodoform gauze, which should be removed in forty-eight hours, the catheter being used meanwhile. Iodised douches should be subsequently given twice daily for a fortnight, during which time small sloughs from the uterine mucosa will be expelled. The operation should not be repeated under three weeks.

Dangers.—Cases are recorded where necrosis of the whole mucous membrane and obliteration of the cavity of the uterus have followed this operation, apparently from the steam being at too high a pressure, or from it having been used for too long a period (Dührssen). Perforation of the uterus has also been described (van der Velde), and pelvic inflammation is stated to occur in 5·5 per cent of the cases; but when carefully carried out, especially as regards antiseptics, Blacker does not consider it more dangerous than any other form of intra-uterine application. Out of 833 cases described by Pincus, 749 were cured or benefited, and 3 died—a mortality of 0·36 per cent.

Atmocausis is mainly indicated in cases of intractable uterine hæmorrhage as an alternative to hysterectomy, or for recurring hypertrophic endometritis with or without fibroids, where curettage has failed to cure.

VI. Intra-Uterine Applications of Electricity

Electricity, except as an agent for the cautery, was but little used in gynæcology till 1886, when Apostoli of Paris published his results of five years' experience of the use of continuous currents of considerable strength. Apostoli's methods were soon adopted by gynæcologists all over Europe in the treatment of fibroids, endometritis, and subinvolution, as well as to encourage the more rapid absorption of periuterine inflammatory products.

Dr. Thomas Keith, writing in 1889, stated that, owing to its heavy mortality, he had definitely given up the operation of hysterectomy for fibroids, in favour of the method of Apostoli. In 1896, when the late Dr. Milne Murray wrote the article on "Electrical Treatment" in the first edition of this *System*, this method of treatment was still extensively used. Soon, however, the advance of surgery made hysterectomy for fibroids so much less dangerous that electricity with its tediousness, its loss of time, its occasional disasters, and its frequent failures, was persevered with by few. Now the swing of the pendulum is so widened that it is probably correct to say that hysterectomy for fibroids is adopted too often, and their electrical treatment is used too rarely. If this be so, it may safely be prophesied that the advantages of these and other alternative methods may in the near future be more truly balanced. It is advisable, therefore, to shortly describe the apparatus required, the procedure which should be adopted, and the indications for its use.

Continuous currents of sufficient strength can be obtained by means of a stationary battery of thirty or forty Leclanché cells of a pint capacity. These give an electro-motive force of about 58 volts, with a total resistance of 20 ohms. With a good abdominal electrode, and a uterine sound *in situ*, the resistance of the human body averages 150 ohms, and the battery is capable of transmitting a current of 300 milliampères, which is more than sufficient for all requirements. Such a battery keeps efficient for a year or more if used at least once a week, and if a little water be occasionally added to the cells. A switch-board is essential for the proper working of such a battery, and should be fitted with galvanometer (and voltmeter), shunt rheostat, and current reverser. Fig. 203 shows a combined switch-board for continuous currents, with induction coil added, suitable for use with a stationary battery or for currents from the main. Portable batteries are sometimes required. A convenient type is made by Schall, weighing 38 lbs., fitted with a current regulator in the form

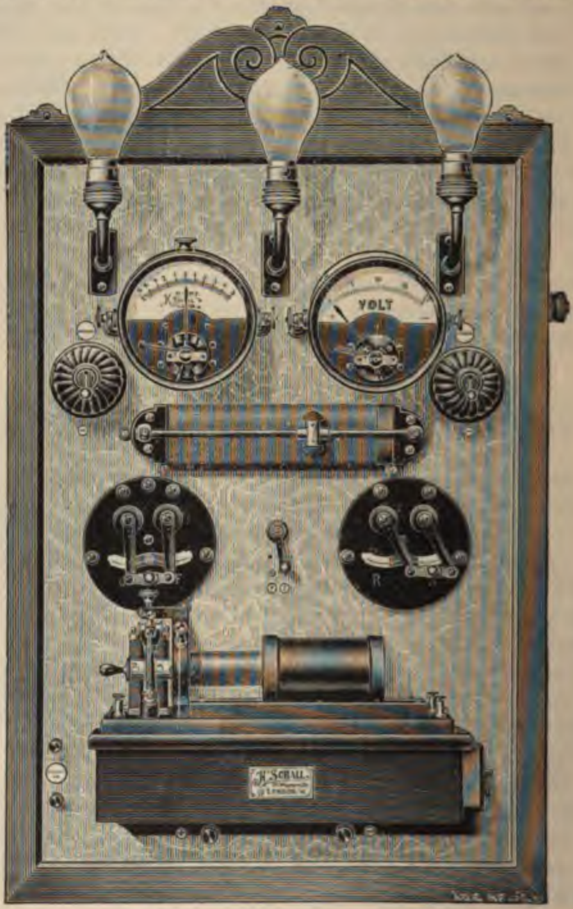

FIG. 203.—Switch-board for both continuous and induced currents.

of a double cell-collector, by which any groups of cells can be used. This collector takes the place of a rheostat, and is on the whole more convenient for a portable battery. The battery is also fitted with Edelmann's or D'Arsonval's galvanometer.

In London, and in many other cities, the most convenient source of energy for electrical treatment is the lighting main of a continuous pressure supply. The old method by which the patient was put into the main circuit "in series" with a resistance interpolated, sufficient to reduce the current as needed, is now superseded by inserting the patient (or cautery burner, etc.) in a "shunt circuit" (Fig. 204) instead of "in series." This prevents disagreeable sensations when "making" and "breaking" contact. By the use of a shunt rheostat (Fig. 205) the old carbon or graphite rheostats, as well as all liquid rheostats, can be discarded. In all cases when current is taken from the main a lamp of a candle-power appropriate to the voltage should be interpolated, to act as a safety resistance, and prevent the passage of more than 250 m.a. The switch-board shown in Fig. 203 is fitted with a shunt rheostat.

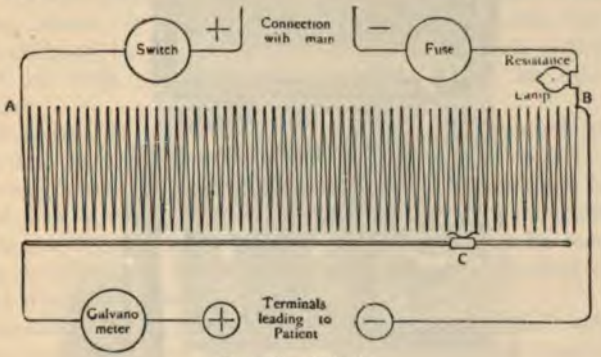

FIG. 204. (Schall.)

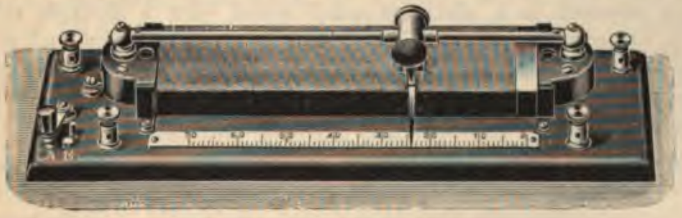

FIG. 205.—Shunt rheostat (Schall).

Induced, Alternating, or Faradic Currents.—A portable apparatus, comprising a dry cell and coil, with the necessary connections, can be contained in a box 5 inches square, weighing 3 lbs. (Fig. 206).

Electrodes.—The external electrode for strong continuous currents used by Apostoli was made of moistened sculptor's clay, half an inch thick, with an area of 100 square inches. A thin sheet of lead 6 inches square, to which one of the connecting cords is attached, is pressed into the upper surface of the clay. This clay electrode is in many respects inconvenient; probably the best type is either a flexible tin electrode of large area, and well padded, or the carbon pad. A convenient intra-uterine electrode is a platinum-ended sound with a movable celluloid sheath, for insulating the portion of the sound in the vagina and cervix.

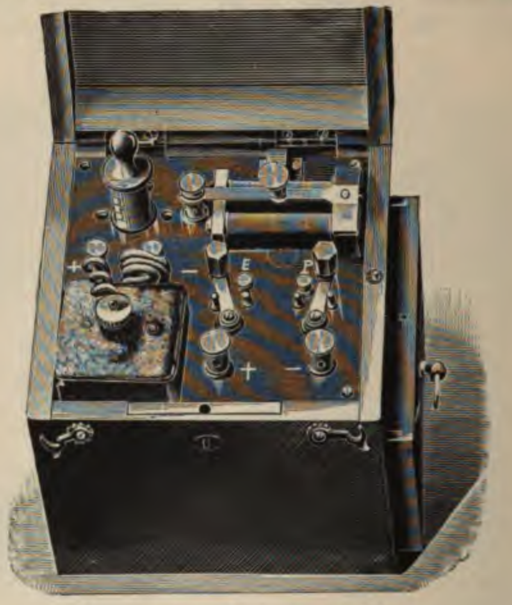

FIG. 206.—Spamer's induction coil (Schall).

Method of making the Application.—Continuous Current.—The patient should be recumbent in bed or on a couch in a warm room, with the clothes arranged so as to leave the abdomen exposed. Antiseptic vaginal douches should have been previously administered. The sterilised platinum-ended sound is now passed into the uterus, and held there by the nurse. The abdominal electrode, properly prepared, is then placed over the abdomen and carefully and evenly pressed down upon it. Any abrasion should be previously covered with oiled silk, and the iliac spines carefully avoided. The connections may then be made to the

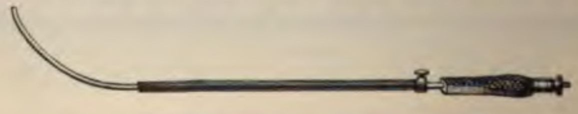

FIG. 207.—Intra-uterine electrode.

battery or switch-board. The current used should at first be weak (say 20 m.a.), and its strength carefully noted by the galvanometer till the required current strength is passing. The duration of the application should be five or ten minutes, after which the abdomen should be dried, and the patient should rest for an hour. The vagina should again be douched shortly afterwards.

Therapeutic Applications of Continuous Currents. — *Stenosis of Cervix.*—The intra-uterine platinum electrode is connected to the negative pole, using about 70 m.a. for five minutes twice weekly for a month. This is considered by some to be more permanent than ordinary dilatation, but its only real advantage is that it can be used without anæsthesia.

Endometritis.—It is probable that the relief of hæmorrhage in the electrical treatment of fibroids is due to the destruction of the adenomatous overgrowth of the endometrium by the astringent and hæmostatic action of the positive pole used internally. Notwithstanding this, the treatment of endometritis by electricity is not to be recommended when one considers the other more rapid and more effectual methods of treatment which are available.

Subinvolution.—A large, flabby, and congested uterus, following abortion or labour, causing pelvic discomfort, hæmorrhage, and leucorrhœa, will certainly involute after electrical treatment. Milne Murray advised that if pain were a prominent symptom a few applications of the induced current should be given first, followed by the continuous current with the positive pole internally. It is a question whether the treatment of subinvolution by electricity should be encouraged when it yields so readily to other measures, and it should certainly not be adopted till other methods have been tried.

Fibroid Tumours of the Uterus.—Strong currents of continuous electricity accurately measured were found by Apostoli, Keith, and others to be of signal use in the treatment of fibroids; it was stated by some that shrinkage, and even total absorption of such tumours often took place. Other observers, such as Milne Murray, considered that a large proportion of such cases were symptomatically cured without appreciable organic change having occurred, and that the cure, except at or near the menopause, was temporary only. Many who began the practice of Apostoli's method in 1886 soon discontinued it as being of little practical utility. We have already seen that the hæmorrhage due to a concurrent endometritis may be relieved by the anodal electrode being applied internally, and Milne Murray and others considered that the relief of hæmorrhage, pain, and pressure is undoubtedly often attained, although the explanation of this is not understood, for it is evident that the internal electrode cannot actually come into contact with the entire lining membrane of a distorted uterine cavity. This symptomatic relief is thought to be due to tonic muscular contraction reducing the vascularity and altering the nutrition of the fibroids.

It must always be remembered that the electrical treatment of fibroids is not without risk, for A. Martin and Mackenrodt had a mortality of 8·3 per cent, and Keith and Schäffer's cases showed a mortality of 4·3 per cent. If in addition to this it is remembered that in 50 per cent no benefit from the treatment results, that in the remainder the cure is only symptomatic, and that it is only permanent when the menopause occurs during treatment, it will be evident that the electrical treatment of fibroids can only be recommended in patients refusing operation, or in those whose health will not permit a resort to surgery. The use of electricity in cases where drugs and diet would suffice to relieve, cannot be too strongly denounced.

In treating fibroids the strength of the current should begin at 50 or 60 m.a. and be gradually increased to 120 m.a. Applications should be made twice weekly, except during menstruation, and the positive pole should be applied internally where there is menorrhagia or metrorrhagia. If pain persist after the hæmorrhage is relieved the negative pole should be substituted.

Electro-puncture of fibroids should be absolutely discarded.

Therapeutic Applications of Induced Currents.—The therapeutic value of induced currents is distinctly limited, but there is no doubt that the induced current with rapid interruptions is of use in relieving pelvic neuralgia or discomfort due to pressure. It is applied by placing a pad electrode at the back of the neck over the upper dorsal vertebræ, and a bulbous metallic electrode with insulated shaft with its end against the portio vaginalis or inserted into the cervical canal. It should be used twice daily for twenty minutes. It is useful in some cases of antemenstrual dysmenorrhœa. Its use causes a numbed sensation in the pelvis, and appears to act by averting spasmodic contractions of the uterine muscle. But even in these last cases it is not more useful than other therapeutic measures, such as slight cervical dilatation, and its use is not to be recommended as of general application. It is probably of more curative value in those cases of chronic exudation following parametritis where the cellular tissue in the pelvic floor and broad ligaments remains for months as hard as stone. Faradism certainly helps absorption in these cases.

Therapeutic Uses of High Frequency Currents.—It is possible that in the near future the germicidal action of these rapidly interrupted induced currents may prove useful in septic states of the endometrium and vagina, but at present nothing has been reported on the subject. The passage of a glass electrode into the uterus would, however, admit of a local germicidal action, and might prove useful in some cases of chronic septic endometritis. Dr. J. Ironside Bruce reports that high frequency currents will cure pruritus pudendi, especially if of septic or parasitic origin.

VII. THERAPEUTIC USES OF RÖNTGEN RAYS AND RADIUM RAYS

The author, with Dr. J. M. H. Macleod's assistance, has tried the effect of radium rays upon inoperable cancer of the uterus, both squamous-celled and columnar-celled, but usually with only symptomatic benefit. The patients lost all pain, felt better and stronger, and the discharge distinctly abated and lost its offensiveness, but the growth continued unchecked in the deeper tissues, and in the case of two squamous-celled epitheliomata the rapidity of the growth seemed to increase. In vulvar lupus and other similar growths the application of X-rays in Dr. Bruce's hands has proved of great value.

It is probable that ere long much will be known of good results obtained in the treatment of cervical cancer by X-rays, and perhaps also by radium rays. Meanwhile only few facts are obtainable. Short-lived and neoplastic cells are devitalised and absorbed, and in superficial cancers necrosis followed by rapid granulation and repair may then occur. The bactericidal action of both X-rays and radium is thoroughly established, as shown by the rapid disappearance of pus and offensive discharges from the vagina after irradiation has been instituted. Crabbe of New York speaks highly of X-ray treatment in cases of post-operative uterine cancer where recurrence is feared, or in inoperable cases. He quotes cases where the patients rapidly gained weight, and pain and discharge ceased; he advises its use in all hopeless or inoperable cases, as it prolongs life, makes the patient comfortable, and her last hours free from pain. Scully of New York also relates cases symptomatically cured, and gives similar advice. Caldwell of New York has described a new method by which X-rays can be applied easily to the cervix, the long projecting horn of the tube being protected by metal foil to prevent injury to other parts.

Important experiments have recently been made by Halbertstaedter on the effect of X-rays on the ovaries of rabbits, and he found that exposure to these rays causes the Graafian follicles to disappear in fifteen days. This tends to bear out the experiments of Albers-Schonberg and Friedel, who showed that rabbits exposed for a period of twenty-five minutes to rays from Crookes' tubes lost all sexual desire and became sterile. Dr. F. Tilden Brown has also stated that men constantly working in an X-ray atmosphere are eventually rendered sterile, becoming the subjects of absolute azoospermia, though there is no deterioration in regard to sexual power.

These effects are probably temporary, but their significance in gynæcology is great, for it may be possible to so devitalise the ovaries as to render them functionless.

VIII. THERAPEUTIC USES OF ELECTRIC HEAT AND LIGHT BATHS

Although the idea of Radiant Heat was originated by Kellog of Michigan, U.S.A., Polano was the first to systematise the treatment of chronic inflammatory pelvic exudations by means of heat generated by electricity. Bier had previously advised similar treatment with heat derived from other sources. It can be carried out by placing the patient undressed in a prepared cabinet with the head alone outside, so that the air inspired is normal. The heat and light is supplied by rows of incandescent lamps of 16 c.p. I have improvised an apparatus which fulfils the purpose admirably for bed-ridden patients, by fixing the lamps along the framework of an ordinary bed-cradle enveloped in mackintosh and blankets; but the best cradle is made of wood lined with aluminium. It is then applied over the pelvis, and has certainly seemed to hasten the absorption of parametritic exudation in the chronic stages in those cases where it has been tried.

It should be applied daily for thirty minutes.

Amand Routh.

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A. R.

PLASTIC GYNÆCOLOGICAL OPERATIONS

This article will not contain a history of plastic gynæcological operations. It appeared to me better to limit my description to the methods adopted in modern gynæcology than to recapitulate all the procedures recommended by the many writers of the past.

Plastic operations in gynæcology may be conveniently considered under six headings :—

A. Those for injuries and lacerations of the pelvic floor, due directly to the process of parturition.
B. Those for displacements of the pelvic floor, including prolapsus uteri, cystocele, urethrocele, rectocele, and vaginal enterocele.
C. Those for uterine displacements, whether treated by the abdominal or the vaginal route.
D. Those for lacerations of the cervix, the result of parturition.
E. Those for certain cervical deformities and inflammations.
F. Those for repair of fistulous openings between the various pelvic viscera.

A. OPERATIONS FOR INJURIES TO THE PELVIC FLOOR DIRECTLY DUE TO PARTURITION

The pelvic floor is composed from within outwards of (1) a pair of broad and thin muscles (the levatores ani), which are the chief means of support of the pelvic viscera ; (2) an arrangement of fasciæ and muscles (more superficially situated), the components of which act as accessories.

1. The levatores ani, with the coccygei muscles, form the true pelvic diaphragm : each levator ani arises from the pubes, the white line of pelvic fascia, and the ischial spine, and sweeping downwards, forwards, and inwards, becomes attached by its anterior fibres, from before backwards, to the lower portion of the vagina, aiding in forming the lateral sulci ; by its middle fibres to the rectum, blending with the internal sphincter ; and by its posterior fibres to its fellow of the opposite side. The coccygei may be said to complete this pelvic diaphragm in its posterior portion. One of the chief functions of this musculature is to elevate the vagina and rectum, and to preserve the slit-like form with bilateral sulci which the former presents on transverse section. By the vaginal sulcus is meant the depression between the centre and side of the vagina which produces a kind of groove on each side.

2. The most external covering of the pelvic floor is a layer of super-

ficial fascia, itself a continuation of the general body fascia; beneath this is a deeper layer, and, finally, there is the so-called triangular ligament, which consists of an anterior and posterior lamina filling in the pubic arch. Between the deep layer of the superficial fascia and the anterior lamina of the triangular ligament three important pairs of muscles are found: (α) The transversus perinei. (β) The bulbo-cavernosus. (γ) The erector clitoridis.

The perineum until recently was considered as a thick wedge-shaped body, partly muscular, partly tendinous, lying between the vagina in front and the rectum behind, and materially aiding in the support of the uterus; we now more accurately regard it as a movable centre of attachment for the transversus perinei, the sphincter and levator ani, and the pelvic fascia; as well as for the lower portion of the rectum and vagina. Thus the levator ani muscle, with the pelvic fascia, forms the true pelvic floor on which the viscera rest, and through which the rectum and vagina find their exit.

The pelvic floor consists of two "segments"—an anterior or pubic and a posterior or sacral—separated by the vaginal slit or cleft; the pubic portion is slightly drawn up, or remains stationary during labour; while the sacral is pressed down and stretched during the passage of the fœtal head through the vulval orifice, hence it is that practically all the lacerations of the pelvic floor requiring repair are confined to the latter segment. These injuries are treated by certain operative procedures which may be immediate (that is, at the time of labour) or remote (that is, at some variable time after the accident, not earlier than eight weeks). This paper is devoted to a consideration of the "remote" operations only, as the "immediate" belong to the department of obstetrics.

The lacerations of the pelvic floor fall into three classes:—

i. *Partial rupture of the perineum.*—This consists of a median tear through the transversus perinei and bulbo-cavernosus muscles, and the superficial fascia up to, but not into, the sphincter ani. It is a frequent result of the passage of the vertex through the pelvic outlet in first labours. As a rule it is productive of no symptoms, but occasionally gives rise to a feeling of descent of the pelvic viscera, to entrance of air into the vagina, and other sensations of a less definite nature. Neither prolapsus uteri nor gaping of the vaginal orifice occurs as a result of this accident.

On inspecting, in the dorsal decubitus, such parts in a woman who has been confined a sufficiently long time for complete cicatrisation to have taken place, it will be noticed that the vulval outlet is somewhat prolonged backwards, but is not patulous; upon separating the labia, a kidney-shaped surface covered by shining cicatricial tissue, paler than usual and without rugæ, will be seen. The sites of the torn ends of the transversus perinei and bulbo-cavernosus cannot, of course, be detected. On being told to bear down, there should be no more than an ordinary descent of the uterus and vaginal walls, and the sphincter will be found intact. The lateral vaginal sulci will be present, and, on passing the finger into each, the supporting band of fibres of the levator ani may be distinctly made out. The sacral will be in apposition to the pubic segment, as is indicated by the close application of the anterior to the posterior vaginal walls.

ii. *Complete rupture of the perineum.* — This is a tear, usually median, through the perineum and internal sphincter ani. A patient suffering from this distressing condition has more or less complete incontinence of fæces and flatus, painful sitting-down, and not infrequently dyspareunia. The appearance of the parts after cicatrisation is somewhat as follows: the anus is represented by an opening, the shape of an isosceles triangle; the base of this triangle is formed by a concave corrugated surface—the posterior margin of the anus; the sides are the edges of the torn recto-vaginal septum. The sphincter ani being completely torn through, the ends have retracted, wrinkling the skin between them; their site is indicated by a small, almost circular depression upon each buttock (Fig. 208). The mucous membrane of the rectum is prolapsed or everted and inflamed; it bleeds easily when touched, and secretes tenacious mucus. On introducing the finger into the rectum

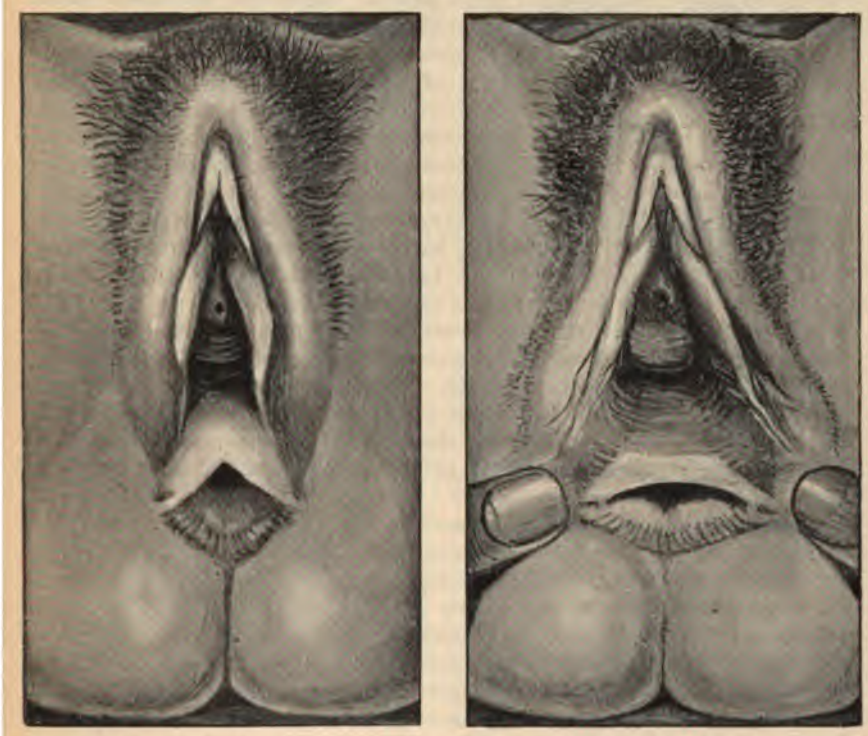

FIG. 208.—Complete perineal rupture (semi-diagrammatic). (After Cullingworth.)

there is a want of grip, and the edges of the torn recto-vaginal septum are more clearly defined. The anterior and posterior vaginal walls are in apposition, and the lateral sulci intact, as in the former case.

iii. *Lacerations of the pelvic floor proper.*—These injuries are usually uni- or bi-lateral, and submucous, being produced by a tearing of the fibres of the levator ani, especially of those attached to the vagina, rectum, and pelvic fascia. It is not until the patient begins to get about that the results of these lacerations are noticed. If the attachments of the levator to the rectum and the vaginal sulci be torn through, the sacral segment is dragged backwards towards the coccyx; the vulval orifice becomes elongated antero-posteriorly; the vaginal walls are everted, and the vulval outlet patulous—the latter condition being recognised in addition by the flatness of the crease between the buttocks, anterior to the anus; and the recto-vaginal wall, instead of being concave, becomes convex and protuberant, so as to produce a rectocele. The finger inserted into the vagina will fail to detect the attachment of the levatores ani to the lateral borders of the lower portions of the vagina; it is probable that the fibres of the levator ani attached to the left vaginal sulcus are those most usually torn, owing to the frequency of the first position of the vertex (Fig. 210).

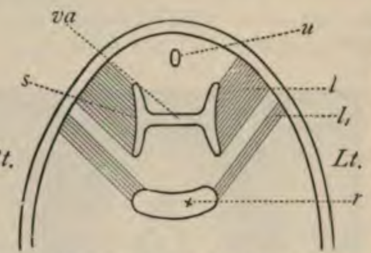

FIG. 209.—Relations of levator ani to the rectum and vaginal walls; normal condition. *u*, Urethra; *va*, vagina seen in section as a slit, with *s* its right lateral sulcus; *r*, rectum; *l*, levator ani muscle (vaginal fibres); $l_{,}$, levator ani muscle (rectal fibres).

Typical instances of classes i., ii., and iii. are frequent, but it must be borne in mind that it is very common to meet with cases in which complete perineal laceration is combined with lateral rents of the levator ani; in such cases the physical signs would present a compound of those depicted under class ii. and class iii.

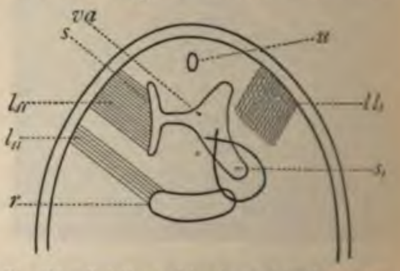

FIG. 210.—Relations of levator ani to the rectum and vaginal walls; injured condition. A deep tear through the vaginal and rectal fibres producing effacement of sulcus, and a patulous vagini. *u*, *va*, *s*, *r*, as in Fig. 209; $s_{,}$, altered vaginal sulcus; $ll_{,}$, torn rectal and vaginal fibres; $l_{,,}$, normal condition. (Diagrammatic, from below.)

It will be more convenient to consider together the plastic operations necessary for the cases in class i. and class ii.; a full description of the technique to be adopted in class ii. will comprehend that of class i.

No plastic operation should be carried out without the full antiseptic preparations described in another place (*vide* pp. 780-782).

Plastic operation for complete laceration of the perineum (class ii.).—There is no procedure which, besides manual dexterity, requires greater care in the preparatory and after-treatment than perineorrhaphy; and in order to describe it accurately, it is necessary to subdivide the subject under four heads, viz:—Preparatory treatment, Denudation, Suturing, After-treatment (*vide* article, "After-treatment of Gynæcological Operations," p. 922). A fifth, namely, stretching of the lacerated sphincter, is often inserted between the first and second of these, and is certainly useful in some cases.

As the rectum communicates directly with the site of the operation, strict asepsis is impossible; at the same time contamination must be prevented as far as circumstances allow. The patient should lie in the dorsal position over a Kelly's pad, with her knees supported and separated by a crutch; a mackintosh sheet, over which is a towel soaked in 1 in 4000 mercurial solution, should be laid under the buttocks; and a flat tray half filled with 1 in 40 carbolic acid solution, and containing the necessary instruments (recently boiled), is placed within easy reach of the operator, who should have gone through the usual purifying process on his own person. Through a Sims' speculum the vaginal mucous membrane and the site of the rupture should be thoroughly and firmly rubbed over with cotton-wool wetted with 1 in 1000 perchloride solution; the labia and parts about the perineum are shaved, and then purified, first with soap and water, afterwards with the solution.

The instruments necessary for the operation are—(1) six pairs of Spencer Wells's artery forceps; (2) artery catch forceps; (3) long dissecting forceps, preferably with hooked points; (4) a pair of sharp-pointed angular scissors; (5) needles of various curves; (6) a needle-holder, either Spencer Wells's or Hagedorn's, according to the needles in use.

Some operators stretch the sphincter, others condemn this practice; among the latter is Emmet. The reason for stretching is that when the torn ends of the sphincter are sutured, the irritation from collection of flatus and the bruising of the parts during the operation are productive of much reflex muscular contraction, which must prevent or seriously interfere with firm union. If stretching be done before suturing, the muscle remains paralysed for forty-eight hours at least, and good union takes place; moreover, after stretching, the ends of the contracted sphincter are more easily accessible. The manœuvre is carried out by grasping the tissues firmly on one side, over the depressed end of the sphincter, with the thumb and first finger of one hand, the patient being anæsthetised, and forcibly stretching the contracted muscle with the other; this action is repeated on the other side.

Denudation may be carried out either by paring, that is, removing a superficial layer of mucous membrane with the knife or scissors in order to leave a bare surface, or by the method termed "flap-splitting." The latter is the process now generally adopted, and must be carefully described.

The skin over the circular depressions (Fig. 208) corresponding to the severed sphincter muscle is seized with the hooked dissecting forceps and slightly raised; with the scissors this portion of skin, say on the right side, should be excised, a procedure which bares the torn end of the muscle and opens up the cellular tissue. The same manœuvre is carried out on the opposite side. The point of one blade of the scissors is now buried in the loose tissue at this bare spot on the right (operator's) side (Fig. 211, *s*), and carried along the edge of the vaginal opening between the superficial and deep tissue, until a point is reached above the level of the apex of the triangle formed by the rent of the recto-vaginal septum (Fig. 211, *a*): a few snips of the scissors will complete the incision; a similar manœuvre is carried out on the other side (Fig. 211, *b*). Starting again from the denuded spot (*s*), the point of the scissors is carried along the edge of the recto-vaginal septum in the direction of the arrow, splitting it into an upper and a lower flap. A similar incision beginning at $s_{,}$ meets this one at the apex of the triangle (*c*). If now the angles at *s* and $s_{,}$ be raised by catch forceps, and the scissors passed carefully into the cellular tissue, it will be seen how easily a flap is raised from the recto-vaginal septum (Fig. 212, *f*), leaving a raw bilobed surface. In Fig. 212 the flap has been raised, and it will be found that *s* and *w*, $s_{,}$ and $w_{,}$ are corresponding letters on the bare surface and flap respectively; the first finger of an assistant's hand in the rectum aids very much in bringing the different parts within reach of the scissors. This flap may be now drawn up out of the way by a tenaculum or temporary suture (Fig. 213) and left to be dealt with later. The bleeding surface should be lightly swabbed over with small pieces of cotton wool dipped in 1 in 4000 perchloride solution and wrung nearly dry. Hæmorrhage is not severe, owing to the pinching action of the scissors; but if it continue, a hot douche of sterilised water at 110° F. should be played over the wound, and a sponge wrung out in water at the same temperature pressed upon it at intervals; if a bleeding vessel can be made out, it must be seized with a Spencer Wells's forceps, which may remain attached until the sutures are passed.

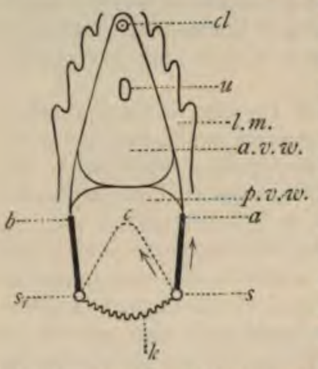

FIG. 211.—Perineorrhaphy: preliminary incisions. *cl*, Clitoris; *u*, urethral orifice; *l.m.*, labium minus; *a.v.w.*, anterior vaginal wall; *p.v.w.*, posterior vaginal wall; *k*, retracted sphincter. (Diagrammatic.)

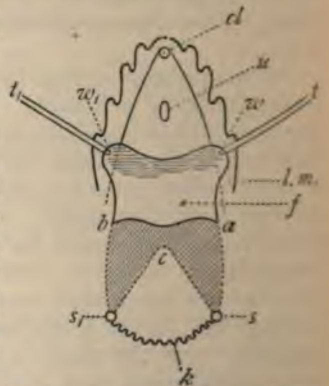

FIG. 212.—Perineorrhaphy: denudation. Flap (*f*) raised by tenacula (*t*, $t_{,}$); *k*, *cl*, *u*, *l.m.*, as in Fig. 211. (Diagrammatic.)

Passage of the Sutures.—The most suitable material is carbolised silk; but silver wire, chromic catgut, and silkworm gut are also extensively used by their respective advocates: a silk suture appears to me to have the greatest advantages. Two sizes are required—a very fine one for repair of the torn recto-vaginal septum, and a slightly stouter material for the perineum proper.

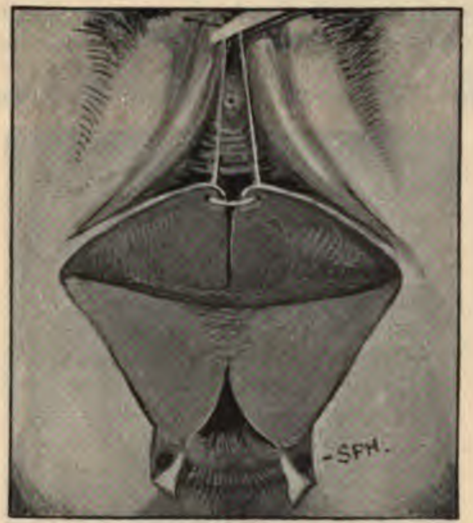

FIG. 213.—Perineorrhaphy: denudation. The recto-vaginal septum separated into two layers and the vaginal flap lifted up by means of a temporary suture. SPH, end of sphincter. (After Cullingworth.)

Closure of the recto-vaginal rent may be performed in two ways—by the purse-string suture, and by the interrupted buried suture.

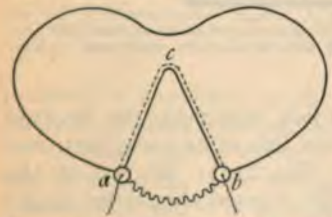

FIG. 214.—Purse-string suture; suture passed. *a*, *b*, Denuded ends of sphincter; *c*, angle of rent.

Fig. 214 illustrates the former method; the point of a fine half-curved needle, in its holder, enters the cut edge of the sphincter at the point *b*; it is then passed up parallel with one side of the rent to the apex of the triangle *c*, brought down on the other side, and out through the other cut end of the sphincter *a*. The two ends are tied tightly, so that the points *a*, *b*, and *c* are approximated, and the muscle repaired. Failure in operations on the perineum is chiefly due to faults in passing the sutures; hence it is of the utmost importance that the severed ends of the sphincter should be carefully brought together.

The interrupted suture is more satisfactory, and consists in passing a series of silk or catgut sutures $\frac{1}{8}$ inch apart as shown in the plate (Fig. 215). The uppermost suture is introduced first; "the threaded needle enters the margin of the rent on the left side (patient's right), traverses the tissues along the dotted line, emerges on the raw surface, re-enters the raw surface on the opposite side (patient's left), and following the dotted line, is finally brought out at a point on the right margin of the rent, exactly opposite the point of original entry" (Cullingworth). Each suture should be tied, and the ends cut short before the next one is inserted; the knots should lie inside the rectum. Great care should be taken that in passing the sutures the rectal mucous membrane itself is not pierced.

It is now seen that a somewhat rhomboidal raw surface is left, as in an incomplete rupture of the perineum already described, the repaired recto-vaginal septum forming a central vertical line in its lower part, and the raised sutured flap in its upper part (Fig. 216); the rest of the operation is extremely simple. The needle selected should be longer and stouter and the suture thicker than for the preceding steps of the operation. The point of the needle is entered on the skin surface close to the raw edge, and pushed across the recto-vaginal septum beneath the denuded surface, emerging on the skin on the opposite side. Three or more other sutures are passed in the same way (I. II. III. IV. V.). Nothing further should be done until bleeding ceases; the Spencer Wells's forceps can now be taken off, and if the surface remain fairly dry an antiseptic douche may be played over the wound, and the sutures tied or the wires twisted. Hæmorrhage occurring after the co-aptation of the

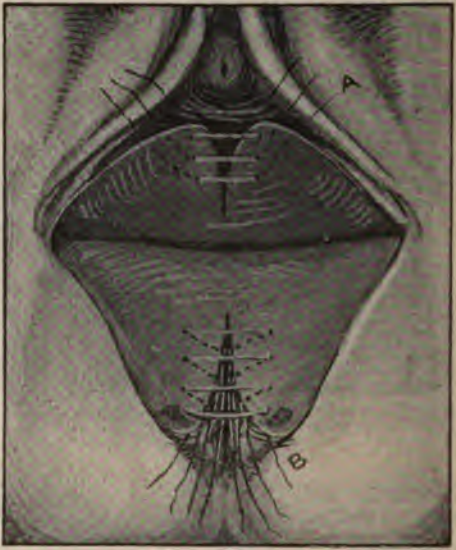

FIG. 215.—Passage of the rectal and vaginal sutures, which, for the sake of clearness, have not been tied. A, sutures in raised anterior vaginal flap; B, sutures in torn rectal wall. (After Cullingworth.)

flaps may prevent union. As the sutures are being secured the legs must be brought together and tied at the knees. The sutures should not be tied too tightly; practice only can enable the operator to gauge the proper amount of tension. If at any part of the wound the edges are not quite in apposition, it is well to insert one or more superficial catgut stitches. The wound is now dusted over with iodoform powder; the urethral orifice is shown to the nurse in attendance to enable her to pass the catheter, and a wood-wool diaper is applied by means of a T-bandage. The patient is then put to bed on her back or side, with her knees tied together and supported over a bolster. No morphia suppository is necessary, as the patient rarely suffers pain, and no agent likely to produce constipation should be administered.

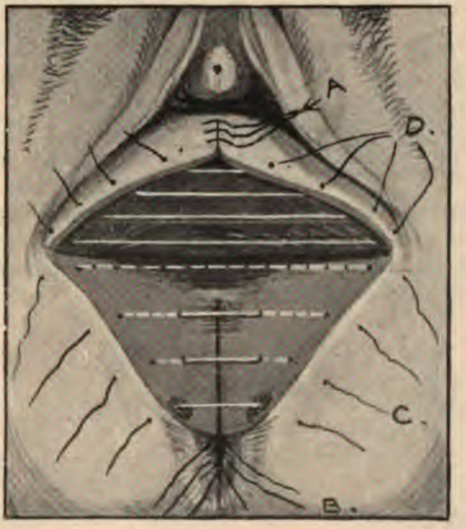

FIG. 216.—Perineorrhaphy. Vaginal (A) and rectal (B) sutures tied. Quadrilateral raw surface left which is traversed by superficial sutures (passed, but not tied), I. II. III. IV. V. *a*, urethral orifice *l*, labium minus; *a*, anal orifice. (After Cullingworth.)

In those cases in which it is not thought desirable to cut away the flap dissected-up, three or more sutures are passed through its substances transversely, and it is, so to speak, longitudinally folded upon itself when these are tied.

Various modifications of this operation are in use, but of these two only need be described here; namely, that of Hegar, who modified Simon's operation (the "Simon-Hegar"), and that of A. Martin of Berlin.

The "Simon-Hegar" operation for complete perineal rupture.—The principle upon which this method is founded assumes that the perineal body is torn on three surfaces, and that, to be successful in repairing the rent, sutures must be inserted on the vaginal, rectal, and external perineal surfaces. The shape of the freshened surface may be compared to a butterfly, the recto-vaginal septum being the body, and a tongue-shaped projection (Fig. 217, *c*) the head. To mark out the area to be denuded a Sims' speculum is inserted to retract the anterior vaginal wall; and plugs of sterilised cotton-wool or gauze are pushed into the rectum to prevent passage of fæces over the wound about to be made. The hooked forceps should then seize the mucous membrane at the point *c*, which point should be in the median line of the recto-vaginal septum, and two cm. above the apex (*a*) of the tear through the sphincter. Two other points to be marked out are the extremities to which denudation is to take place on the inner surfaces of the labia majora (b $b_{,}$). This butterfly-shaped area must now be bared of its mucous membrane by means of a knife or scissors; there is no flap-splitting.

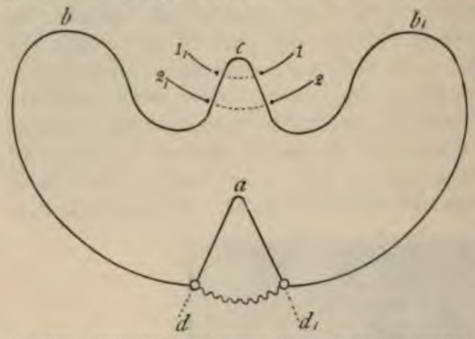

FIG. 217.—Perineorrhaphy (Simon-Hegar method of suture). *a*, Angle of recto-vaginal rent; d $d_{,,}$ sites of torn ends of lacerated sphincter muscle; *c*, central tongue denuded and two sutures, 1 $1_{,,}$ 2 $2_{,,}$ passed; b $b_{,,}$ extremities of denuded surfaces on labia majora.

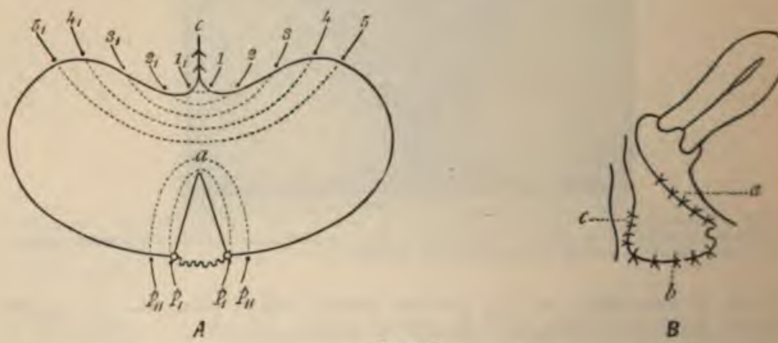

FIG. 218.

A. Simon-Hegar method of suture, 2nd stage. The sutures 1 $1_{,,}$ 2 $2_{,}$ in the tongue *c*, have been tied. 1 1, 5 $5_{,,}$ Vaginal sutures passed; $p_{,}$ $p_{,,}$ p_{II} $p_{,,,}$ perineal sutures passed.
B. Simon-Hegar method completed (side view). *a*, Vaginal sutures tied; *b*, perineal; *c*, rectal.

Lateral venous sinuses may give rise to troublesome bleeding, but otherwise the hæmorrhage is inconsiderable. Hegar warns operators against baring too extensive a surface, for when so much tissue is included between the stitches, suturing is rendered much more difficult and union less likely to take place.

The small central tongue should first be sutured and the stitches tied; two or three are sufficient (Fig. 218 A, *c*). This gives additional solidity to the recto-vaginal septum. Next the sphincter should be repaired, the needle being passed as is indicated in Fig. 218 A, $p, p_{,,}$. The knots of these sutures will lie in the anterior rectal wall. The vaginal and perineal stitches are next inserted in the usual way.

A. Martin's Method.—The denuded surface is the same as is recommended by Hegar and Simon, but the mode of suture is quite different. The flaps are brought together by the use of the continuous suture in superimposed layers. The needle is entered at the apex of the central triangle, and continued downwards, so as to unite the edges of the recto-vaginal septum and thus repair the sphincter; an upward direction is now taken with the next superimposed layer, and finally the direction of the needle is again changed, and makes a series of superficial stitches from above downwards. Greater rapidity in the performance of the operation, and a closer adaptation of the raw surfaces, are the chief objects attained in this method.

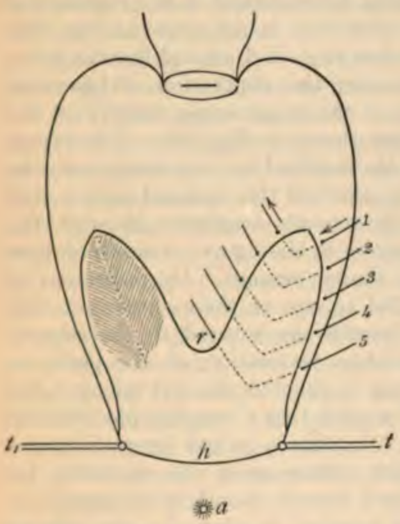

FIG. 219.—Surface view of posterior vaginal wall with right and left lateral sulci; the anterior wall supposed to be removed: on left side (patient's) sutures inserted, right side as the sulcus appears untouched. 1 to 5 sutures; their mode of passage being indicated by arrows; *h*, hymeneal edge; *t* $t_{,,}$ sites of attachment of tenacula; *a*, anus; *r*, crest of rectocele.

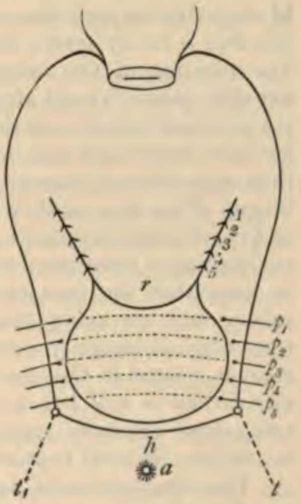

FIG. 220.—Same view as Fig. 219 with both lateral vaginal sulci sutured, 1, 2, 3, 4, 5. Quadrilateral raw surface with sutures passed p_1 p_2 p_3 p_4 p_5 but not tied; *r*, crest of rectocele; *a*, anus; *h*, *t t*, as before.

Plastic operations for lacerations of the pelvic floor proper (class iii.).—The treatment to be adopted in these cases differs very materially from the preceding; the objects to be attained are, first, to suture the torn ends of the levator to the lateral vaginal sulcus and perineum, and, secondly, to draw up or "lift" the pelvic floor.

The patient, both as regards diet and antiseptic precautions, is prepared as in the former case; and is placed in the dorsal decubitus. A

Sims' speculum is inserted, and so placed as to elevate the anterior vaginal wall; the lateral sulci and the posterior wall are thus exposed.

With the left forefinger in the rectum, the space to be denuded is mapped out by means of the sharp-pointed scissors, as shown in Fig. 219, the base-line of the double triangle being formed by the site of the hymen (*h*); it is best marked out by inserting a tenaculum about three-quarters of an inch from the urethra on each side ($t\ t_{,}$), and using slight tension. The tip of the tongue between the two triangles should be situated on the most prominent point or crest of the rectocele (Figs. 219 and 220, and *r*). The whole of the incisions must be contained in the vagina, and not extend to the vulva. The mucous membrane is now removed from this M-shaped space, particular care being taken to go deep enough into the sulci; bleeding is rarely severe enough to require the application of ligatures. The insertion of the sutures is begun at the upper angle, usually on the left side (patient's) and after the manner shown in Fig. 220. The suture (1) is passed from the outside towards the median line; not straight across, but first downwards and inwards to the centre of the denuded surface, and then upwards and outwards towards the mucous membrane through the tongue of the flap, as shown by the arrows in the figure; a series of four or five of these sutures is passed in a similar manner. On inspection of an imaginary transverse section parallel to one of these sutures, it will be seen that the torn ends of the levator are sutured to the relaxed sulcus, and on tying the knot complete restoration of the parts to their original integrity results. Having completed the left triangle, the right is treated in the same way, and we find that a roughly quadrilateral raw surface is still left below (Fig. 220); this is united by passing and tying four or more transverse buried sutures as in the operation for incomplete perineal rupture: a Y-shaped cicatrix should be the result.

The after-treatment is exactly as detailed in class ii.; the sutures usually remain buried, cause no irritation, and do not require removal.

This is practically the operation devised by Emmet, and the steps of it are, with very few exceptions, the same as those laid down by him twenty-five years ago.

B. OPERATIONS FOR DISPLACEMENTS OF THE PELVIC FLOOR

Prolapsus uteri may be looked upon "as a downward and outward displacement of the entire displaceable portion of the pelvic floor, past the entire fixed portion," with eversion of the walls of the vagina (Berry Hart). Simple prolapsus may be complicated by more or less procidentia of the anterior and posterior vaginal walls, and by a varying amount of hypertrophy of the cervix. Prolapse of the anterior vaginal wall may occur alone or carry the posterior bladder wall down with it (cystocele). Both conditions are frequently cured by the same operation (anterior colporrhaphy), although for the latter a special one has been devised (Stoltz). In a similar manner prolapse of the posterior wall may be simple; or there may be in addition a displacement downwards of the anterior rectal wall (rectocele); both of these are treated by elytro- or colpo-perineorrhaphy. The operative treatment of cystocele, enterocele, urethrocele, and prolapse of the urethral mucous membrane will be considered seriatim.

For the purpose of selecting a suitable operation in each case it is better to divide these lesions into four divisions :—

(*a*) Prolapsus uteri and procidentia vaginæ (cystocele and rectocele, etc.), associated with cervical hypertrophy. (*b*) Prolapsus uteri and procidentia vaginæ, without cervical hypertrophy. (*c*) Prolapsus uteri with retroversion, and procidentia vaginæ. (*d*) Simple procidentia vaginæ without uterine prolapse.

The various plastic operations to which resort can be had for the relief of the above conditions are :—

(i.) Those performed chiefly with the object of giving support to the prolapsed parts by repairing the perineum (perineorrhaphy); or, in addition to this, suturing together the inner edges of the pared labia majora (episio-perineorrhaphy). (ii.) Those performed with the chief object of narrowing the vaginal walls (elytrorraphy or colporrhaphy), or making a vaginal partition (Le Fort's operation). (iii.) Combinations of i. and ii. (elytro- or colpo-perineorrhaphy). (iv.) Those for prolapse of the posterior bladder wall with anterior vaginal wall (cystocele) of the urethra (urethrocele), of the urethral mucous membrane, and of the intestines (vaginal enterocele). (v.) Those tending to cure the metritis and cervical hypertrophy (curettage, cervical amputation). (vi.) Those for the relief of the retroversion and prolapse (vaginal fixation, hysteropexy, or ventral fixation and suspension).

(i.) Operations performed with the chief object of giving support to the prolapsed parts.

(*a*) *Perineorrhaphy* or suture of the perineum has already been described (p. 818). Since the site of the operation scarcely includes the vaginal walls, it does not prevent their eversion; although it may contract the vulvar outlet. It is a useless and inadequate procedure in any but the mildest cases, and simply enables a pessary to be retained.

(*β*) *Episio-perineorrhaphy.* This operation consists in paring the inner and lower borders of the external labia in addition to the perineal surfaces, and suturing the opposing denuded areas together. The same objection obtains here as in perineorrhaphy, and, except for the purpose of supporting a pessary, it is found to be equally useless.

(ii.) Operations performed with the object of narrowing the vaginal walls.

(*a*) *Anterior Colporrhaphy.*—(Sims's operation). This operation is only performed on the anterior vaginal wall; as originally devised a V-shaped surface was denuded, with the apex pointing downwards and commencing just above the urethra. On suturing these surfaces together, a pocket was found to exist near the cervix into which the latter was liable to become incarcerated. Sims therefore added two short transverse denudations at the ends of this V (Fig. 221, *a a*,); on passing the sutures and tying them, a complete vertical fold of the anterior vaginal wall is produced, which in suitable cases will be found to act as an adequate uterine support. Hegar makes his denuded surface in the form of a lozenge or rough ellipse, with the longer diameter in the axis of the vagina: he considers it useless to endeavour to make the flap of any particular shape, and advises the excision of all the redundant anterior vaginal wall. For practical purposes the denuded surface must be made of a more or less oval shape (Fig. 222); its upper border reaches as near the cervix as possible according to the amount of mucous membrane which can be drawn down to the vulva, while its lower edge is four-fifths of an inch behind the urethral orifice. The cervix is drawn down and steadied with a silver wire passed through its anterior lip. A Sims' speculum, lateral retractors, or the fingers of the assistant, may be used to expose the site of operation. Having marked out the area to be denuded with a scalpel, the upper edge of the flap should be seized with hooked forceps, and the sides steadied by tenacula; the mucous membrane can now be separated from the underlying tissues by means of a knife or scissors and gentle traction; the edge of the knife should always be turned towards the flap, to avoid cutting too deeply. Bleeding is as a rule very slight; if it persist, Spencer Wells's forceps should be applied and allowed to remain attached until the passage of the sutures, or a ligature may be used.

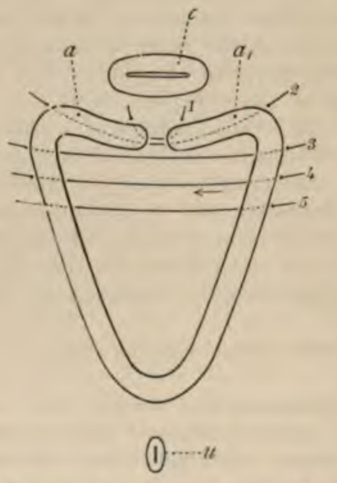

FIG. 221.—Elytrorrhaphy (Sims). The denudation is complete. $a\,a_{,,}$ Transverse bared surfaces; 1 2 3 4 5, sutures passed; c, cervix; u, urethral orifice.

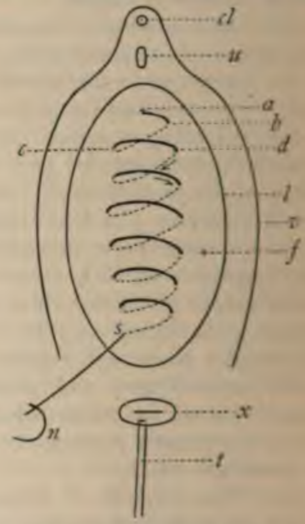

FIG. 222.—Anterior colporrhaphy; denudation and first layer of continuous suture completed. a to s, course of suture, the dotted portions being buried; f, denuded surface; x, cervix; t, tenaculum; n, needle; v, vulvar outlet; cl, clitoris; u, urethral orifice.

Closure of the wound may be carried out by means of a deep and superficial layer of interrupted sutures; or by two or more layers of superimposed continuous sutures. The latter method is much the more expeditious, and will therefore be described. A small half- or fully-curved needle threaded with a long piece of fine carbolised silk, a needle-holder, and a pair of hooked dissecting forceps will be required. The first suture is passed and tied (but not cut) near the urethral end of the incision (Fig. 222, *a*); the point of the needle is then entered at *b*, is passed beneath the denuded surface obliquely across to *c*, and then brought out, remaining exposed from *c* to *d*: it is then again passed obliquely beneath the surface, in the direction of the arrows; as each loop is passed it is tightened, and the silk kept taut by an assistant while another loop is being passed. In the figures these loops are shown as still remaining loose in order better to demonstrate their mode of insertion. On drawing the suture tight, a longitudinal line is produced between the two opposed folds (Fig. 223, *k k,*), and the denuded area will be diminished in size from side to side. The needle being brought out at *s* (Fig. 222), the silk is kept tense, ready for the suturing of the next layer. The point of the needle is passed superficially from *a* to *b* (Fig. 223) over the longitudinal line (*k*), that is, from the operator's left to his right. It is then passed back again in an opposite and upward direction beneath the raw surface, and emerges at *c*; it is superficial again from *c* to *d*, and buried again from *d* to *e*; the route taken by the needle being in the direction indicated by the arrows. The end of the suture is now brought out at *s*, and, if the denuded area be small, it may be tied and cut short. If, however, a third layer be necessary, the same procedure must be gone through, but from the urethral end downwards, the needle passing through the edges of the mucous membrane (Fig. 224). The needle has therefore during the

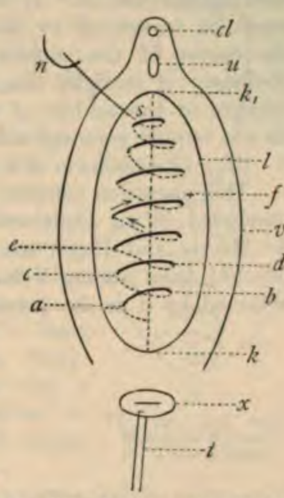

Fig. 223.—Anterior colporrhaphy; passage of second continuous superimposed suture. *k k,*, The longitudinal puckering produced by the first layer of suture. The other letters as in Fig. 222.

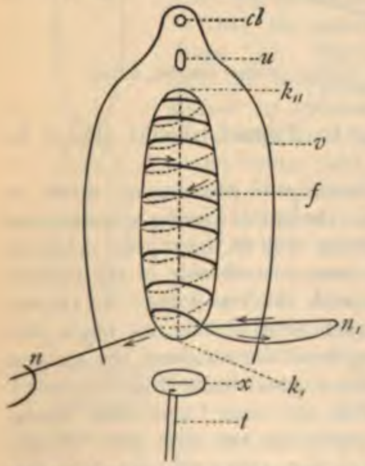

Fig. 224.—Anterior colporrhaphy; passage of third and final layer of superimposed suture. *k, k,,*, Site of second layer; *n n,*, arrangement of silk preparatory to tying knot to complete operation.

operation passed from urethra to cervix, from cervix to urethra, and back again to cervix. It is important to remember that the deeper layer must be transfixed by the loops of the more superficial layer during the course of the suture from side to side. The final cicatrix is obviously a straight line, running from the cervix to just above the urethra in the middle of the anterior vaginal wall. The deeper sutures do not require removal unless suppuration occurs along their track.

(iii.) Combination of i. and ii. (Elytro- or Colpo-perineorrhaphy).

This operation consists in the performance of a posterior colporrhaphy concluded by an additional perineorrhaphy. The methods advocated by A. Martin and Hegar are those most in vogue; the former has been selected from among a large number for description. The advantage obtained by it is the preservation of the posterior column of the vagina, which is very resistant, and, according to Freund, should always be maintained intact.

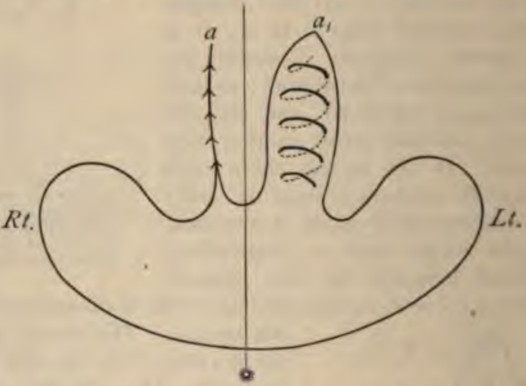

FIG. 225.—Colpo-perineorrhaphy (A. Martin). 1st stage. Surface denuded, sutures passed (a_1) and tied (a).

A. Martin's Operation.—The usual antiseptic precautions must be taken in this as in all plastic operations; the patient being anæsthetised and placed in the dorsal position, the posterior wall of the vaginal *cul-de-sac* is seized by two pairs of hooked forceps, one on each side of the median line. Some traction is put upon them, with the result that the vaginal column appears strongly marked. On each side of this are made two longitudinal incisions; two corresponding flaps are removed, the amount varying according to the redundancy of the vaginal walls (Fig. 225, a a_1). The continuous buried suture is applied to each, and two linear cicatrices result (Fig. 225, a). This concludes the first part of the operation or the posterior colporrhaphy; the perineorrhaphy has now to be performed. The boundary lines are almost the same as in the operation for incomplete perineal rupture, the contained space presenting a semilunar appearance while the parts are at rest; but when traction is made upon its lower or anal extremity it assumes a lozenge shape

(Fig. 226). The deep and superficial superimposed buried suture is now passed after the manner already described, and the operation is concluded; a Y-shaped scar results (Fig. 227). If antiseptic precautions have been carefully carried out, no suppuration takes place along the track of the sutures, and these may be left untouched.

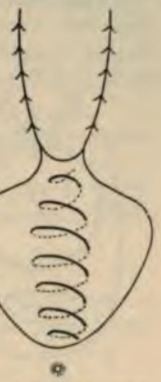

FIG. 226.—2nd stage. First layer of superimposed suture passed.

(iv.) Operations for Cystocele, Urethrocele, Prolapse of the Urethral Mucous Membrane, and Enterocele.

(*a*) *Cystocele.*—Whether the prolapsed anterior vaginal wall carry down the posterior bladder wall or not, the operative treatment is the same; namely, by anterior colporrhaphy, just described, or by another method devised by Stoltz of Nancy.

The instruments necessary are a No. 8 male bladder sound, two tenacula, hooked forceps, sharp-pointed angular scissors, half-curved needles, and a holder (Spencer Wells's or Hagedorn's, according to the kind of needle used). Fine carbolised silk is preferable for the suture.

The parts are exposed with a Sims' speculum and a silver wire passed through the cervix (Fig. 228, *x*), by means of which traction downwards and backwards may be exerted. Four points must be selected: two lateral (1 1,), fixing the external boundaries of the surface to be bared, one behind the urethral orifice (2), and another in front of the cervix (3): these four points should be capable of fairly close approximation. They are united by curved incisions, so that the space to be denuded is almost circular in shape (*f*). The sound is now passed into the bladder, and the mucous membrane of the vagina kept on the stretch by pressure of its point. Denudation should be performed in the usual way with knife or scissors, the sound being used as a guide and a resistant body. As a rule bleeding does not require attention. The needle being threaded, its point is inserted on the right (operator's) side of the urethral orifice, and slightly below it; it pierces the mucous membrane, and appears again upon the surface; is again introduced, and again made to come out on the mucous surface. This manœuvre is repeated all round the edge of the wound, and finally the thread brought out on the left (operator's) side of the urethra and below it (Fig. 228). Traction is then made upon the two ends of the suture at the same time that the sound (now removed from the bladder) is used to push in the projecting cystocele. The edges of the denuded surface are by this means drawn together and the prolapsed bladder wall restored to its normal situation. On tying the ends of the silk suture, the site of the operation will be marked by a pouch-like cicatrix. The urine should be

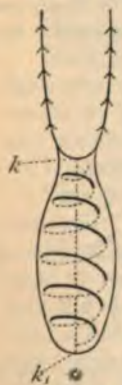

FIG. 227.—3rd stage. Superficial layer of superimposed suture passed; operation complete.

drawn off every six or eight hours, and the suture withdrawn about the tenth day.

This method is of great value when combined with Martin's or Hegar's colpo-perineorrhaphy for the treatment of cystocele and rectocele. It results in a very firm circular cicatrix, and requires very little manual dexterity for its performance. The objection to Stoltz's method is that his operation tends to draw the cervix downwards; hence with a uterus prolapsed in a state of ante-version it would tend to aggravate the condition.

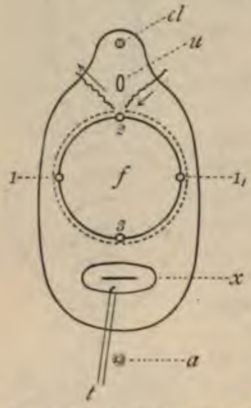

FIG. 228.—Stoltz's operation for cystocele. *f*, Denuded area; 1 1,, 2 3, points of attachment for tenacula before denudation; *cl*, clitoris; *u*, urethral orifice; *x*, cervix; *t*, wire or tenaculum; *a*, anus.

(β) In *urethrocele* there is a localised dilatation of the urethra in its middle third, the neck of the sac being more or less constricted. A certain amount of urine collects in this sac, and becomes alkaline or putrid (Fig. 229). The sac should be opened by means of scissors, or Pacquelin's cautery, and allowed to drain until the parts are in a more healthy condition; a very simple plastic operation can then be carried out, the edges of the wound being denuded and brought together by a deep and superficial set of interrupted sutures.

(γ) *Prolapse of the urethral mucous membrane* is recognised by the appearance at the meatus of an easily reducible swelling of deep-red colour. This condition seldom requires treatment; when necessary the prolapsed mucous membrane may be destroyed under anæsthesia with Pacquelin's cautery.

(δ) *Vaginal enterocele* may be either anterior or posterior; the anterior is so rare that it may be neglected. In posterior vaginal enterocele the intestines are forced down between the anterior rectal and posterior vaginal walls (see p. 691); as a consequence a large mass is found projecting like a rectocele. The cervix and uterus, however, remain in their normal situation. The patient being anæsthetised, and in the dorsal position, a volsella is attached to the posterior lip of the cervix, and some traction downwards and forwards is used; a space upon the cervix is then denuded of its mucosa, and a corresponding one on the posterior vaginal wall; these raw surfaces are then sutured by means of carbolised silk in the usual manner, after reduction of the intestine.

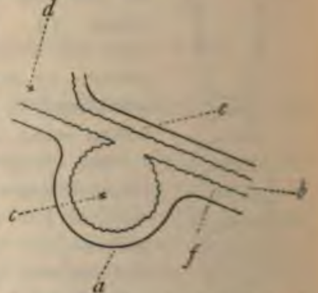

FIG. 229.—Urethrocele: lateral view in section. *a*, Vaginal surface of sac; *b*, urethra; *c*, cavity of urethrocele; *d*, bladder; *e*, anterior wall of urethra; *f*, posterior wall.

(v.) Amputation of the cervix may be necessary for either supravaginal or infravaginal hypertrophy.

Supravaginal hypertrophy of the cervix is essentially a hypertrophy of the cervix above its insertion into the vagina; it occurs, as a rule, in nulliparous women. The uterus is increased in weight, which causes prolapse. It should be noted that in this variety, as the uterus descends, prolapse of the upper part of the vagina takes place first, whereas in prolapsus uteri of the multiparous woman rectocele and cystocele precede the uterine prolapse.

Infravaginal hypertrophy — or more properly "elongation" — may occur:—

1. As a complication of prolapsus uteri, when it is apparent only; reduction of the displacement usually results in a disappearance of the hypertrophy.

2. As a congenital condition.

Amputation of an apparently elongated cervix in prolapsus uteri is rarely justifiable, but in the congenital form a plastic operation is certainly indicated (*vide* p. 840).

C. OPERATIONS FOR THE RELIEF OF DISPLACEMENTS OF THE UTERUS

These are numerous, but may conveniently be considered under the following heads:—

I. Shortening of the round ligaments, or Alexander's operation (extra-peritoneal).
II. Fixation of the uterus to the anterior vaginal *cul-de-sac* by the vaginal route.
III. Ventral fixation or suspension.

Intra-peritoneal shortening of the round ligaments, of the broad ligaments, and of the utero-sacral ligaments have been described, but the results at present are of doubtful value. Combinations of the above may sometimes be carried out with advantage at one sitting.

I. Shortening of the round ligaments, or Alexander's operation.

This procedure may be divided in four stages:—

(*a*) After shaving the pubes, the pubic spine is carefully located with the fingers, and the skin incised for about two inches from a little inside this point in an upward and outward direction and parallel to Poupart's ligament. The knife is carried through all the tissues down to the aponeurosis of the external oblique muscle. The depth of the wound depends upon the amount of adipose tissue present. The superior external pudic artery may be wounded, but this accident is of little consequence (Fig. 230).

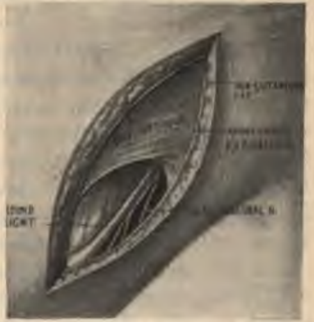

Fig. 230.—Alexander's operation: the round ligament exposed. (After Montgomery.)

(*b*) The external abdominal ring should now be searched for; detection is made easier by looking for the oblique fibres crossing it and for "a small morsel of fat issuing from its inner end." After cutting the oblique fibres a reddish lump of tissue bulges out, "so characteristic in appearance as to be easily recognised, mixed with a greater or less amount of fat." This is the distal end of the ligament just before it is lost in the labium majus.

(*c*) An aneurism needle should be passed beneath this mass and the posterior adherent fibres separated; this should be cautiously carried out, as the ligament may be easily torn across (Fig. 231).

(*d*) The two ligaments are now to be shortened and fixed; they are pulled upon, but not tightly, until the fundus uteri is brought under the pubes. While they are held in position suturing must be carried out. This is best described in Alexander's own words:—

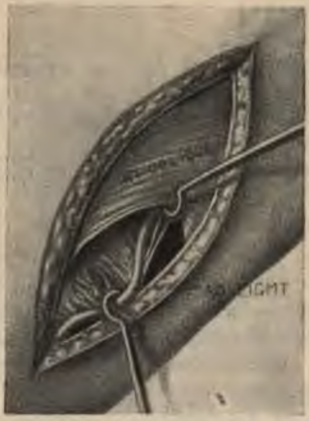

FIG. 231.—The round ligament being drawn out. (After Montgomery.)

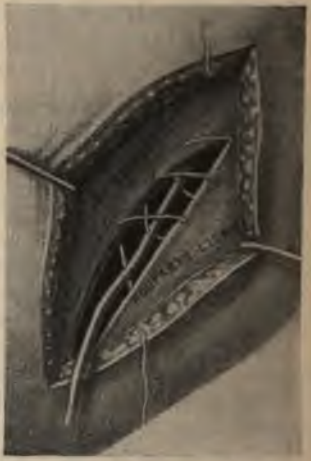

FIG. 232.—The round ligament sutured. (After Montgomery.)

"A curved needle, threaded with fine silkworm gut or fine silver wire, is passed through the outer part of each pillar of the external abdominal ring and through the intervening ligament, and tied loosely as a buried suture. Another suture is passed in like manner internal to the first (Fig. 232). These sutures should not be pulled so tight as to strangle the ligament. A small drainage-tube is passed into the canal about ¼ inch to prevent any collection there, and so eliminate the only danger of the operation. It protrudes at the inner angle of the wound."

A few special sutures should now be passed to bring the edges of the wound together. Alexander himself prefers silkworm gut for the stitches; others use silk, chromic catgut, or simple catgut. The use of a Hodge's pessary is advisable for two months subsequent to the operation.

Modifications.—Martin's *auto-plastic* method.—After isolation of the ligaments in the above-mentioned manner, he passes a closed pointed artery forceps from the bottom of the lower end of the wound on the right side beneath the suprapubic tissues on a level with the aponeurosis to the corresponding point in the lower angle of the wound on the left side. Grasping the round ligament of the left side with the forceps, he then, by withdrawing the forceps, brings the left ligament beneath the skin, fat, and fascia to the lower angle of the side of the right wound. The two ends are then tied to one another in a double knot. Closure of the canals and wound are carried out in the usual way. An almost similar procedure was recommended and performed by Batchelor in 1894 (*New Zealand Medical Journal*, 1894, No. 4).

Indications.—(1) Retro-versio or flexio uteri of old standing, where the application of a pessary either gives pain, or does not keep the uterus in its normal situation, or where the patient is desirous of getting rid of the worry and anxiety of wearing an instrument. (2) Retro-versio or flexio uteri with prolapse of the ovary or ovaries, which prevents the wearing of a pessary. (3) Prolapsus uteri in the first degree. (4) As an additional means of cure when combined with trachelorrhaphy and colporrhaphy for prolapsus uteri (first degree) and vaginæ. *Contra-indications.*—Adhesions about the uterus and appendages; prolapsus uteri in the second and third degrees.

It must be borne in mind that one or both ligaments may be absent, and although they may easily be found, in some cases they may be so slender in calibre as to be useless for the purpose of suspending the uterus. Mundé found that in 10 per cent of cases the ligaments were not thicker than an ordinary knitting needle. Martin has collected reports of 144 pregnancies in which this operation was previously performed. Of these 134 terminated naturally, and only 5 relapses were noted later on.

II. Vaginal fixation consists in fixing the retroverted fundus uteri in a forward or anteverted position by suturing it to the anterior vaginal *cul-de-sac.* This operation, which was originated by Shucking, has been improved by Dührssen, and modified in some of its minor details by Mackenrodt; neither of these operators opened the peritoneum in their earlier operations. Later Küstner, Vineberg, and others deliberately cut through the vesico-uterine pouch, in order to pass the uterine sutures at a higher level.

Dührssen's Operation.—The patient being under the influence of an anæsthetic is placed in the dorsal position, with knees supported and kept apart by a Clover's crutch. The genitalia are thoroughly cleansed with 1 in 1000 mercurial solution, and, after inserting a Sims' speculum, the vaginal mucous membrane is carefully swabbed with cotton-wool dipped in the same mixture. The anterior lip of the cervix is now seized with a volsella, and the uterus dragged down as low as possible; the uterine cavity is slightly dilated, and then scraped with a sharp flushing curette; possible contamination of the uterine sutures to be passed later is thus avoided. If the cervix be much hypertrophied it is amputated, as a large cervix tends to prevent the uterus remaining in a position of anteversion. A superficial transverse incision is made with a scalpel at the insertion of the anterior vaginal wall into the cervix; with scissors and the fore-finger, the cellular tissue (Fig. 233, *d* $d_{,}$) between the bladder and cervix is broken down until the peritoneum lining the utero-vesical pouch is reached. The peritoneal cavity is now opened and the edges sewn to those of the vaginal wound.

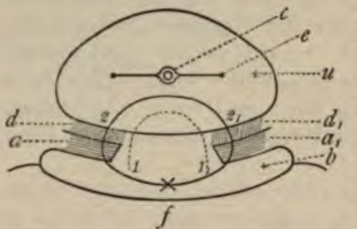

FIG. 233.—Vaginal fixation; transverse and somewhat oblique section above the level of the internal os uteri. 1 $1_{,}$, Temporary uterine suture; 2 $2_{,}$, suture including vaginal flaps, *a* $a_{,}$, and uterine wall; this is tied at X; *b*, anterior vaginal *cul-de-sac*; *d* $d_{,}$, cellular tissue in front of uterus; *c*, catheter in *e*, uterine cavity; *u*, uterine body; *f*, bladder.

A No. 8 silver male catheter is now passed into the uterus, and by means of the usual *tour-de-maître* it is anteverted; by pressing the handle backwards, the fundus, covered by the peritoneum, appears at the incision wound. With a handled needle provided with a rectangular curve, a stout carbolised silk suture or silkworm-gut stitch is passed through the anterior wall of the uterine fundus as high up as possible, the vaginal flaps not being included; the ends of the suture are given to an assistant, who exerts traction downwards, allowing of the introduction of two or more sutures into the anterior wall higher up than the first; the last should pierce the uterus at the level of the catheter point (Fig. 233, 1 $1_{,}$). These are temporary, for traction only. Three sutures should now be passed one above the other through the uterine wall, but including the edges of the vaginal flaps (2 $2_{,}$). The temporary ligatures may now be removed and the permanent ones tied; a superficial continuous suture may be inserted to obtain an accurate adaptation of the flaps. The uterus will now be felt in a state of anteversion. After washing out the uterine cavity with an antiseptic solution the vagina must be packed with iodoform gauze. The patient should be kept at absolute rest for fourteen days, and have a ring pessary inserted before getting up.

The value of this proceeding is still uncertain. The three dangers of the operation are—(i.) cutting one or both ureters; (ii.) wounding the bladder; (iii.) hæmorrhage from the vaginal flaps. Two after-effects must be taken into consideration, namely, a certain irritability of the bladder and a tendency to miscarriage, owing to the fixation of the anterior uterine wall to the vagina. It has been denied, however, by many that either of these sequels are met with. Dührssen has recently published statistics of 197 cases with one death (about 0·5 per cent). He now advocates a transverse incision, to which he sutures the plica vesicæ, while the uterus is united to the peritoneum of the plica, and is thus fixed by peritoneal adhesions only.

Mackenrodt's Modification.—This operator does not consider it necessary to open the peritoneum in the anterior *cul-de-sac*, and is strongly opposed to fixing the uterus by carbolised silk suture or silkworm-gut stitches; he transfixes the *body* of the uterus in preference to the fundus, and also prefers a longitudinal vaginal incision. The advantages claimed for this method are:—1. That the longitudinal incision avoids the risk of injury to ureters or bladder, and further, where the vagina is roomy, and its walls lax, this incision can be converted into a rhomboidal one; thus an anterior colporrhaphy can be carried out, which strengthens the point of attachment of the uterus. 2. That by using absorbable catgut the uterus is maintained in place purely by adhesions, which in the event of pregnancy ensuing are capable of being stretched; repeated miscarriage after this operation is thereby avoided (Webb).

The *indications* usually laid down for vaginal fixation appear to be backward displacements of the uterus with or without adhesions, and with or without diseases of the adnexa in which surgical interference for one reason or another is demanded. Operation is considered to be particularly appropriate when the retroversion is complicated by moderate prolapsus uteri and prolapsus of the anterior vaginal wall. It is *contra-indicated* in certain cases of congenital retroversions. The proceeding may be of value in fat subjects, where Alexander's operation and ventral fixation are undesirable.

Vaginal Fixation in Relation to Pregnancy subsequent to the Operation.—As a large number of cases have now been reported, we are in a position to judge of the effect of the operation on pregnancy and labour. Dr. van de Velde was one of the first to call attention to the risks attendant on the parturient woman who had previously been subjected to this procedure. In a case of his, version was found impossible, and Porro's operation was performed, with a fatal result. Strassman also reports a labour attended by great difficulty, owing to the firm adhesions of the fundus uteri. Ruhl gives the result of 10 cases of pregnancy and labour in his 235 cases. In 7 a normal labour resulted, while in 3, in consequence of delay, podalic version was necessary. In two subsequent cases one required perforation, and in the other an incision was necessary in front of the os uteri through which the forceps was applied to the head of the child. He especially recommends making as little scar tissue as possible, and condemns the fastening down of the fundus uteri. Vineberg, who is opposed to Dührssen's method, has collected 58 cases of labour, including those published by Ruhl. In 9 of these interference was necessary; namely, 1 Porro, 1 Cæsarean section, 2 cervical uterine incisions, and 5 versions. Leopold condemns vaginal fixation of the uterus entirely, and certainly the general trend of opinion at the present time seems to be in the same direction.

III. Abdominal Fixation.—The uterus may be attached to the anterior abdominal wall by means of two distinct operations—(1) Ventro-suspension, (2) Ventro-fixation. In the first procedure, which should be carried out where there is the possibility of a future pregnancy, the uterus is fixed only to the peritoneum and sub-peritoneal tissues. In the second the uterus is attached in addition to the fascia and the recti muscles.

(1) *Ventro-suspension* is best performed by Kelly's method. The

patient having been prepared in the usual manner, the abdomen is opened in the median line by a 2 cm. incision, and the pelvis slightly elevated. "The peritoneum is opened the full length of the skin incision and caught with artery forceps in the middle of both sides, drawn out, and the forceps laid on the abdomen" (Fig. 234). This step ensures the retention of enough peritoneum to close the peritoneal wound separately at the end of the operation. The index and middle fingers are then introduced into the peritoneal cavity to elevate the fundus uteri, and if there are any adhesions binding it down they should be gradually separated by the fingers; if dense, scissors or the scalpel may be necessary. If the ovaries and tubes are diseased they should be treated accordingly by extirpation or plastic procedures. To overcome the difficulties of the intestines bulging into the wound and thickness of abdominal walls Kelly has introduced an elevator (Fig. 235) which acts as a temporary artificial support until the first suture is passed. The next important step is the attachment of the uterus to the abdominal wall. "This is done by raising one side of the lower angle of the incision with two fingers in order to expose the inner surface; the peritoneum and sub-peritoneal tissues parallel to the incision are

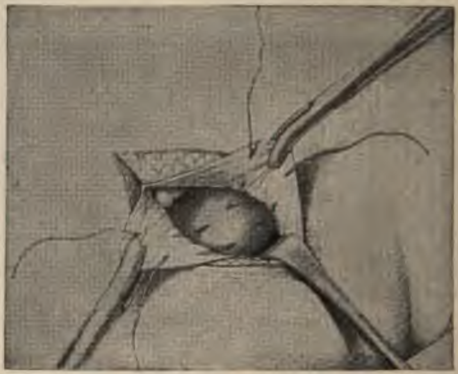

FIG. 234.—Ventro-suspension. The abdomen has been opened and the peritoneal flaps held aside by forceps; in the lower angle of the wound is a retractor. The two sutures have been passed. (After Kelly.)

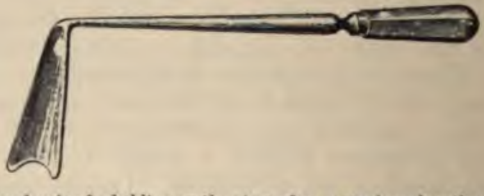

FIG. 235.—Lower elevator for holding up the uterus for suspension when the pelvis is deep; the anterior face of the uterus rests in the hollow of the elevator. (After Kelly.)

now transfixed at a point 1 to 1½ cm. away, including an area 8 to 10 mm. broad" (Fig. 236). The same needle next transfixes the fundus uteri, "through a part of the posterior surface of the uterus 1 or 2 cm. below a line connecting the uterine tubes"; the suture takes in uterine tissue about 1 cm. in breadth and 3 to 4 cm. in depth. The needle is next carried through the peritoneum and sub-peritoneal tissue on the opposite side. This suture is now drawn together, tied, and the ends cut away. A second one is passed in a similar way just below the first. By this manœuvre the uterus is lifted up and held in a state of anteflexion by the first ligature, while the second serves to bring more of its posterior surface into contact with the parietal peritoneum. After ascertaining that no omentum or intestine is caught in either of the loops the abdomen is closed in the usual manner.

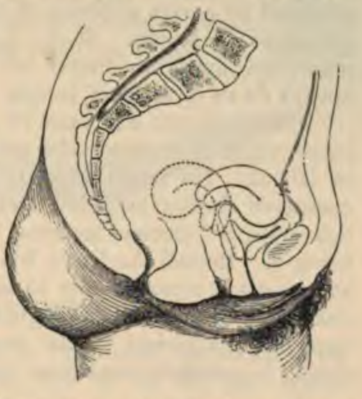

FIG. 236.—Suspension of the uterus. Diagram showing the position of the uterus in retroflexion in dotted line, and the position of the uterus held in anteflexion by the two suspensory sutures. The peritoneum is shown yielding. (After Kelly.)

The after-treatment is as in other abdominal operations, the patient being kept at rest for three weeks, and a subsequent four weeks should be allowed to elapse before any exertion is taken.

(2) In *ventro-fixation* the preliminary steps of the operation are on the same lines, but the sutures are carried through the sheath of the rectus, the muscle itself, sub-peritoneal fascia, and peritoneum, on either side, so that the fundus is firmly attached to the abdominal wall. As opposed to the attachment of the posterior part of the fundus in this way, Leopold and Czerny produce direct attachment of the anterior part of the uterine body to the abdominal wall by sutures.

Indications for Abdominal Fixation.—Kelly lays it down as an axiom that "suspension of the uterus should be resorted to only in cases of persistent retro-fixation which refuse to yield to simpler methods of treatment through the vagina, and then only when the discomforts of the retro-fixation are sufficient to interfere seriously with health."

The actual indications for this operation appear to be (*a*) retroversion of the uterus, with discomfort, bearing down, and backache, all worse after exertion, with digestive disturbances. Should these symptoms be relieved by lying down, and especially if pushing up the uterus and packing the vagina gives temporary relief, the indication for the operation is more marked. (*b*) A retroflexed adherent uterus resulting from perimetritis, with adhesions of the ovaries and tubes. (*c*) A prolapse of the uterus in the third degree.

The *objections* to the operation of fixation of the uterus are: (1) The uterus is fixed in an abnormal position. (2) The attachment of the uterine fundus to the abdominal wall must interfere with the dilatation of the bladder, and thus cause dysuria in some form. (3) Intestinal obstruction may result from adhesions. (4) Pregnancy ensuing may be attended by severe suffering of various kinds, and lead to disastrous complications in labour. It is, however, fairly clear that although these objections apply in nearly all cases of ventral fixation, they do not always do so in those of ventral suspension.

Martin reports 425 cases of pregnancy following ventral fixations and suspensions. Of these, 329 were normal in gestation, 309 were normal in labour. He found, moreover, that there were many difficulties encountered during gestation and labour, namely, 9 versions, 13 forceps deliveries, 8 Cæsarean sections, 1 ruptured uterus, the maternal mortality being 6. Russell Andrews has recently shown that when the body of the uterus is attached only to the parietal peritoneum, there is much less risk of difficulty during pregnancy and labour than when the uterus has been firmly attached to the muscular and fascial layers. These points should be carefully considered before recommending operation.

D. OPERATIONS FOR LACERATIONS OF THE CERVIX (NOT RECENT) THE RESULT OF PARTURITION (EMMET'S OPERATION OR TRACHELORRHAPHY AND ITS MODIFICATIONS)

If the cervix of a woman who has been confined at least two months be exposed by means of a Sims' speculum, one or more of the following conditions may be observed :—

(α) The cervix may be normal, with the exception of two more or less marked lateral notches.

(β) The anterior and posterior lips may be separated by one or two lateral rents extending to the vaginal roof.

(γ) One or two lateral lacerations may be present, and in addition considerable extroversion of the cervical mucous membrane; the uterus probably will be subinvoluted. If a tenaculum be applied to the outer surface of each lip, and the two approximated, the extroversion disappears, and the rent becomes more apparent.

(δ) The anterior lip may be torn through from front to back, the posterior being intact; or the reverse may obtain, the posterior lip only being injured. Extroversion may or may not complicate either of these injuries.

(ε) The lacerations may be stellate in form and of varying depth.

Of these varieties none but those included under the headings (γ) and (δ) require operation, and then only when extroversion is also present. Until recently it was considered that there was a direct relation between cervical lacerations and cancer; but so far no affirmative evidence has been adduced in support of this surmise, and the necessity for the performance of this operation does not therefore frequently arise.

(γ) *Operation for simple deep bilateral laceration with extroversion.*—The instruments required are:—a Sims' speculum; volsellæ and tenacula; long-handled angular-bladed knives (right and left); Emmet's scissors (right and left), angular (Fig. 237) and angular and curved (Fig. 238); needle-holder; short stout needles, with sharp triangular points, straight or very slightly curved; two sizes of silver wire; carbolised silk (medium thickness). The patient may be placed in the dorsal decubitus, with a crutch and a weighted speculum (Fig. 38) or in the left lateral position (Sims).

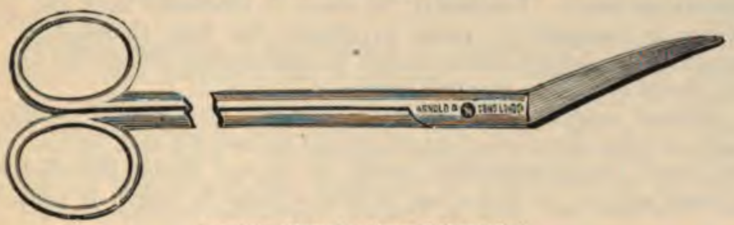

FIG. 237.—Emmet's scissors (left angular).

As subinvolution is almost invariably present, it is considered advisable to commence by *slight cervical dilatation and curettage*; it takes but a few more minutes, and is of great benefit to the patient. Having performed this with a flushing curette (*vide* p. 798), introduce the speculum and expose the cervix. A piece of stout silver wire (Fig. 239, $w_{,}$) should be passed deeply through the anterior lip ($a_{,}$). By means of this, steady traction can be made downwards, and the uterus kept firm while denudation and suturing are carried out. If there be marked extroversion, with hypertrophy of the cervical glands, and the parts bleed easily on handling, erasion by means of the curette will make the subsequent steps easier of performance.

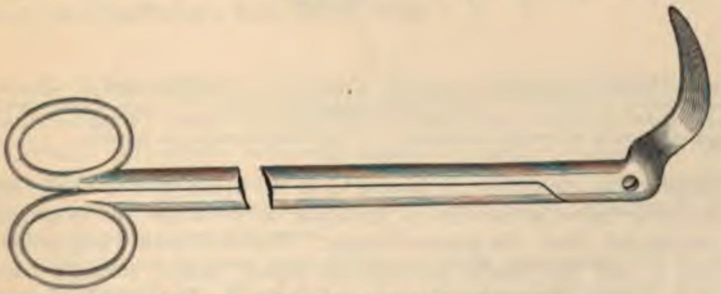

FIG. 238.—Emmet's scissors (angular and curved).

Having passed the uterine sound to mark the site of the internal os uteri (*o u i*), *denudation* is commenced. The lower portions of the anterior and posterior lips are first pared by means of the angular knives and scissors. An important site which frequently escapes is the deep angle of the laceration on each side ($l\ l_{,}$). The upper portions of the anterior and posterior lips may now be treated in a similar manner. A sufficiently broad strip ($a\ a_{,}$) must be left unpared on both lips to avoid complete closure of the cervical canal when suturing is carried out. Any cicatricial tissue at or about the angles of the laceration should now be excised; but, in doing so, large vessels may be opened and serious hæmorrhage result. Frequently the tissue is extremely hard, and great patience is necessary in order to denude the flaps thoroughly. An intermittent antiseptic douche should be used during denudation to wash away the blood and to preserve asepsis.

Silvered copper wire of medium stoutness, and about 12 inches in length, or stout chromicised catgut, should be used for each suture. The short, stout triangular-pointed needle (n) is first doubly threaded with carbolised silk ($s_{,}$), so that a loop of 3 or 4 inches in length is produced.

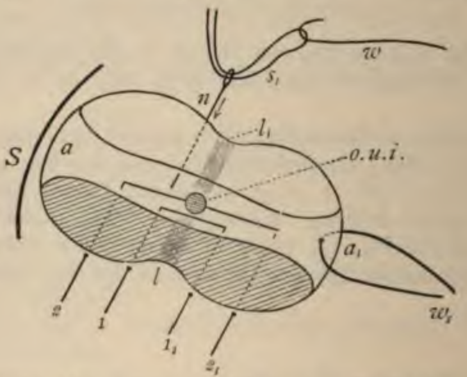

FIG. 239.—a, Posterior cervical lip; $a_{,,}$ anterior cervical lip; $a\ a_{,,}$ undenuded strip; $w_{,}$, stout wire by which cervix is steadied; S, Sims' speculum (blade in section); $l\ l_{,,}$ angles of deep laceration; $o\ u\ i$, os uteri interum; n, needle passing through upper bared surface; $s_{,,}$ double thread, through loop of which the wire suture w is passed; $1\ 1_{,,}$ $2\ 2_{,,}$ sutures inserted but not tied.

The needle and silk suture are passed, as in the upper portion of the figure, on the lower bared surface in the direction of the arrow, the loop remaining suspended from the point of entry. The wire suture (w) is hooked through it, and the needle and silk are rapidly pulled through beneath the raw surface, drawing the wire in their track. The needle is entered again at the edge of the undenuded strip, and passed directly outwards, the same manœuvre with regard to the silver wire being carried out. The other sutures are passed in a similar way; generally three or four are sufficient. The upper bared surface is treated in a like manner. The stout wire ($w_{,}$) is now removed, and the anterior and posterior flaps ($a_{,}\ a$) are brought into apposition. The wires are twisted, but not too tightly; and the sound is passed to test the patency of the cervical canal. The ends of the wire sutures may be cut short or twisted together, covered with protective gauze, and allowed to remain in the vagina. The latter method permits much easier access to the stitches when their removal is required. Vaginal gauze packing is not necessary.

Should secondary hæmorrhage occur the cervix must be exposed through a Sims' speculum, and a suture passed through that half from which the bleeding is taking place. On tightly tying this the hæmorrhage will cease. The sutures may be removed on the tenth day, a small blunt hook being required to bring the loop of wire within reach of the scissors. In a successful case the cervix assumes a virgin appearance.

Dührssen describes a modification of Emmet's operation by "flap-splitting." He considers that a cervical laceration may be repaired without denudation by cutting into the tear at the line of junction of the cervical mucous membrane and that of the portio, the incision being ½ cm. in depth. On putting traction on the wound edges, a raw surface is produced, the upper half of which is to be sutured to the lower. Another advantage claimed is that the cicatricial bands extending from the laceration into the parametric tissue can be safely divided.

Should the tear of the cervix have extended into the parametric tissue a cicatrix results, which draws the uterus over to the affected side. Severe pain may be caused by this condition, and Martin has proposed and carried out a plastic operation for its relief. The patient being anæsthetised, and in either the dorsal or left lateral position, the uterus is pulled over from the affected side, and a semilunar anterior-posterior incision made over the base of the broad ligament, following the line of the cervix. The anterior and posterior extremities of the wound are brought together by sutures, so that a transverse cicatrix results. Martin reports excellent results from this method.

E. OPERATIONS FOR CERTAIN CERVICAL DEFORMITIES AND INFLAMMATIONS

Cervical deformities requiring operation include stenosis of the os uteri externum and infravaginal hypertrophy; in chronic and intractable inflammation of the mucous membrane of the cervical canal resort to the knife is also sometimes necessary.

1. For *stenosis of the os uteri externum*, when associated with a conical cervix, Marckwald has introduced a flap operation which will be described in the next paragraph.

2. *In hypertrophy of the vaginal portion* there is no thickening of the mucous and underlying tissues, hence the diameter of the cervix is not increased. On examination, the anterior and posterior fornices are in their normal situation, and the fundus uteri is found at its proper level in the pelvis; the sound may pass from 4 to 6 inches into the canal of the cervix. The os uteri externum is frequently very small. For the treatment of this condition nothing avails but removal of the hypertrophied portion; many methods have been recommended for this purpose, of which two have been selected for description, viz.:—

(*a*) Circular amputation (Hegar).

(*b*) Wedge-shaped excision of each lip (Marckwald).

A modification of these is advocated by A. R. Simpson.

Circular amputation.—Hegar has fully described his technique in his work. The patient being anæsthetised and in the dorsal position, the cervix is pulled down by a volsella and amputated transversely with knife or scissors, a certain amount of shrinkage of the stump takes place, producing an inversion of the vaginal mucous membrane (Fig. 240, A, *a*). A raw surface remains, over which the vaginal and cervical mucous membranes must be united by sutures. These are passed in the following manner: a short, straight needle, double-threaded with a loop of carbolised silk, is passed from the vaginal mucous membrane (beneath the raw surface of the stump) to that of the cervix (*c*) in the direction of the arrows, and then brought back over the surface (Fig. 240, A $1\ 1_{,}$).

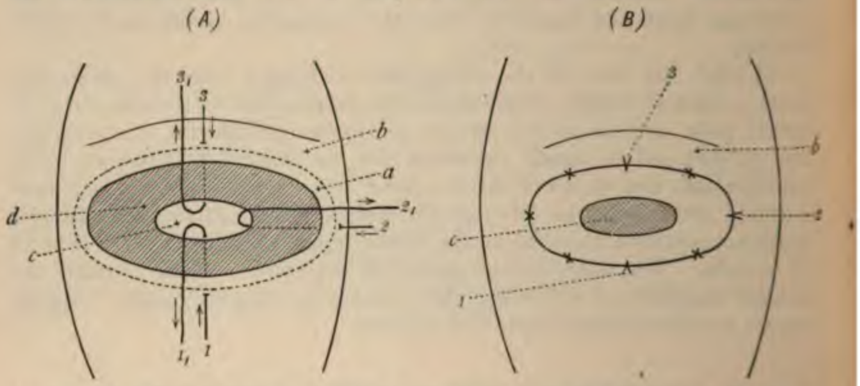

FIG. 240.—Amputation of cervix (Hegar). (A) Mode of passage of sutures; *a*, inverted vaginal mucous membrane; *b*, cervix; *c*, cervical canal in section; *d*, raw surface of stump. (B) Sutures tied; letters and figures as in A.

Into this loop is hooked a piece of silver wire about 10 inches long, and by means of the silk pulled through the stump, which thus takes the place of the original suture: a series of these are passed and arranged in a radiating manner ($1\ 1_{,}$, $2\ 2_{,}$, $3\ 3_{,}$), and the wire loops are twisted so as to secure accurate adaptation and union by first intention (Fig. 240, B). Chromicised catgut sutures may be used instead of silver wire. The patient should remain in bed for fourteen days, and the sutures are best removed on the tenth day.

The Wedge-shaped incision has been in general use in Germany since the publication of Marckwald's original paper on the subject. The cervix is split into an anterior and posterior lip by means of scissors or the knife (Fig. 241, A, *a b*), and out of each is excised a wedge-shaped piece leaving a deep groove (Fig. 241, A, $c\ c\ c_{,}\ c_{,}$, B, $c\ c_{,}$), bounded by an anterior (B, $d\ d_{,}$) and posterior (B, $e\ e_{,}$) flap, front and back; the cervical surface of each is united to the corresponding vaginal surface by a series of sutures which are passed as shown in the diagram.

The sound should be passed to ascertain if the cavities of cervix and body together do not exceed 2½ to 3 inches. The advantages of this operation appear to be that it is almost entirely free from danger; no after-bleeding can take place, and, as a patent external os uteri is produced, it is of much value in stenosis; lastly, the technique is very simple and convalescence is rapid.

Prof. Simpson of Edinburgh introduces the sutures before amputating the hypertrophied cervix, the needle being passed through the whole thickness of the organ. After removing the mass each stitch is cut in two at the site of the cervical canal, and the stump treated as in Hegar's method. In this method "it is easier to pass the needle through the dense tissue when the cervix is fixed with the volsella; the sutures serve as a means of traction when the portion grasped by the volsella has been cut away." Ligatures can be tied immediately the flaps have been made by amputation (Hart and Barbour).

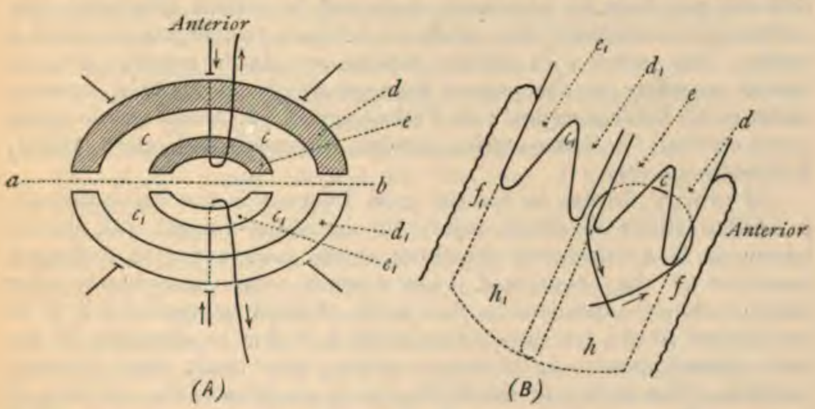

FIG. 241.—Amputation of the cervix (Marckwald's method). (A) Surface view. *a b*, Incision dividing cervix into anterior and posterior lips, in each of which is a wedge-shaped groove, *c c*, $c_1 c_1$. The direction and mode of passage of two sutures is shown. (B) Side view. The dotted outline indicates the original dimensions of the cervix *h h*, *f f*, anterior and posterior fornix; *d e*, $d_1 e_1$, anterior and posterior flaps of anterior and posterior lips of cervix respectively; $c c_1$, as in A.

If the sutures are of silver wire they should be removed in about ten days' time by means of a Sims' speculum, a rake (a blunt bent probe) to bring the embedded sutures into view, and a pair of scissors.

The removal of a hypertrophied cervix by an écraseur or galvano-caustic wire is not to be recommended.

3. In certain cases of *intractable cervical catarrh*, it is a legitimate proceeding to excise the mucous membrane lining the cervix. This is usually performed by the method of Schröeder, which has been described already in another place, in connection with the treatment of chronic cervical catarrh (p. 241).

F. OPERATIONS FOR REPAIR OF FISTULOUS OPENINGS BETWEEN THE VARIOUS PELVIC VISCERA

It will be convenient to subdivide fistulas into those which lead to an involuntary escape of urine through the vagina (urinary) and those in which intestinal contents are similarly passed (fæcal). A rare variety is also described, in which the intestine (small or large) opens into the bladder, and fæces are passed with the urine, constituting an entero-vesical fistula.

Urinary Fistulas.—The septum between the genital and urinary channels may have its continuity destroyed in various situations; any artificial communication thus produced between two organs is called a fistula. The varieties of urinary fistulas are six in number, and are named according to the organs between which an artificial opening occurs:—1. Urethro-vaginal; 2. Vesico-vaginal; 3. Vesico-utero-vaginal (juxta-cervical); 4. Vesico-uterine (cervical, corporeal); 5. Uretero-vaginal; 6. Uretero-uterine.

Of urinary fistulas, by far the most frequent is the vesico-vaginal; it is due either to direct injury to the vesico-vaginal wall during labour, or to a subsequent sloughing of the same, owing to prolonged impaction of the fœtal head. Incontinence occurs immediately after labour, when the accident is due to the forceps or version; if it be not noticed until a few days subsequently it is due to sloughing of the parts pressed upon.[1] An ulcerated opening may result from a vesical calculus. This variety of fistula frequently complicates the extension of malignant disease from the uterus to the bladder wall, and is sometimes artificially produced as a means of cure for chronic cystitis (Emmet's operation) (p. 657).

The urine dribbles away involuntarily, in a more or less continual stream; and the passage of the catheter gives a negative result. An exception, however, is found in those cases in which the opening exists above the orifices of the ureters; the patient then has a more or less considerable retentive power when in the erect position.

In urethro-vaginal fistula the urine is retained in the bladder, but passed in a stream through the lower portion of the vagina. In uretero-vaginal fistula urine is voided voluntarily at the usual times, and if the catheter be passed into the bladder a certain amount of secretion (but not so much as usual) is drawn off; the vagina will at the same time be found moistened with urine. This accident may be a sequel of total extirpation of the uterus. It will be most convenient to describe (I.) the operative treatment of vesico-vaginal fistula; and (II.) the more complicated varieties.

I. Vesico-vaginal Fistula.—As this lesion is usually the result of prolonged pressure during parturition, its situation will necessarily depend upon the point at which this pressure was most strongly exerted; hence it is usually found in the median line and behind the symphysis pubis. If, however, at the time of labour the bladder were distended, and therefore above the symphysis, the solution of continuity will usually be above the ureteral orifices. The size of these openings varies very much; the whole vesico-vaginal septum may be destroyed, producing an aperture as large as the palm of the hand; or the orifice may be so small as to escape notice, and admit a bristle only. The usual shape is oval or elliptical; but should cicatricial bands in the vaginal wall be present, the edges of the aperture may present every variety of irregularity. In the larger kinds the anterior bladder wall is protruded through the opening and may be covered with incrustations of phosphates. The continual flow of alkaline and often decomposing urine over the vaginal walls and external genitals produces much redness, soreness, and swelling of the parts; urinary concretions may be formed along the edges of the fistula or in the vagina. A urinous odour emanates from the patient's person. Amenorrhœa often accompanies this condition.

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[1] The mode of production of these fistulas in connection with labour has been more fully discussed on p. 722.—ED.

The plastic means adopted for the cure of vesico-vaginal fistula are numerous.

Suture. — Three operators have each introduced a method of denuding and suturing a fistulous opening to which their names are respectively given; they are Sims, Simon, and Bozeman.

(i.) *Sims' method.*—This is chiefly characterised by the careful preparatory treatment of the patient before operation, and by the use of silver wire for sutures; it is much in vogue in England and America. The importance of the preparation of the patient cannot be over-estimated; without it, failure will almost inevitably occur. Constitutional treatment by means of tonics, and a stay at the sea-side, with a course of shampooing and careful dieting, must be carried out for a month or six weeks. Hegar and Kaltenbach think six to eight weeks after the labour is the best time for operation. Much care and patience are necessary in the local management of such a case. The chief object to be attained is a healthy condition of the edges of the fistula, which are frequently inflamed, thickened and covered by urinary deposits, usually phosphatic in nature. These deposits should first of all be removed by means of a soft sponge, and the raw surface brushed over with a weak solution of silver nitrate. Frequent hot vaginal douches and hip baths should be administered, and the parts carefully dried afterwards. The vaginal mucous membrane and vulva are then smeared freely with vaseline to protect them from the action of the irritating urine.

So long as the phosphatic condition of the urine is present no local improvement will take place, hence it is desirable to produce acidity, and the following prescription is best adapted for that purpose:—Acid. benzoici ʒj., Acid. borici ʒiss-ʒij., Aq. ℥vj.; $\frac{1}{12}$th part in water three times daily. When a state of acidity is attained the dose may be reduced to such a quantity as to just keep the urine acid; too long a continuance of the larger dose is apt to produce gastric disturbance.

Vaginal cicatrices often obstruct the view and treatment of the fistula, the introduction of sutures being thereby rendered impossible. These should be severed by scissors in preference to the knife, as the hæmorrhage is less. A Sims' glass vaginal tube is then passed into the vagina to prevent reunion of the raw surfaces, and it may be worn a few hours daily.

The following instruments are necessary:—A Sims' or weighted speculum; two flat spatulas; three long-handled knives, one with a long haft and a short, straight, narrow blade, the other two with angular blades (right and left) (Fig. 242); two long-handled, sharp-pointed, curved scissors (right and left); uterine hook (Emmet's) for making counter-pressure (Fig. 243); wire-adjuster (Fig. 244); volsella and tenaculum; Spencer Wells' forceps; long toothed forceps; six sponge-holders for very small sponges; needle-holder and curved needles (from ¾ to 1 in. long) with points not too sharp and cutting; silver wire and carbolised silk sutures; two sigmoid (S-shaped) catheters.

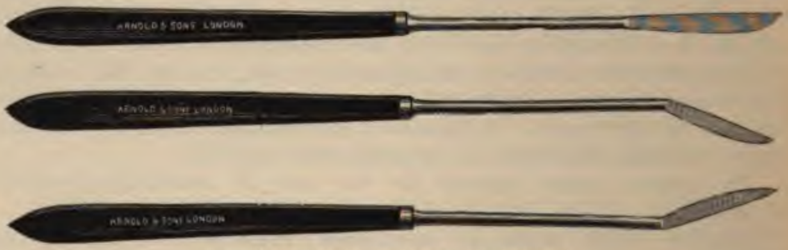

FIG. 242.—Vesico-vaginal fistula knives (Sims).

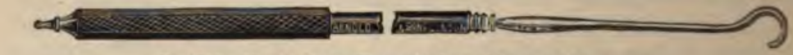

FIG. 243.—Uterine hook (Emmet's) for making counter-pressure.

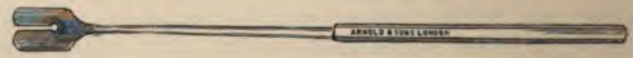

FIG. 244.—Wire-adjuster.

The patient is placed in the left semiprone or dorsal position. The fistula is thoroughly exposed, and a strong light thrown on to the site of operation by means of the speculum; if necessary the cervix may be pulled downwards and backwards by means of a volsella attached to the anterior lip. The tenacula are applied at the opposite sides of the fistula to ascertain where the least traction will bring the edges together. This being ascertained, the highest point of the fistulous edge is seized, either by long toothed forceps or a tenaculum, and placed slightly on the stretch. By means of a straight or angular-bladed knife (Fig. 242) a strip of mucous membrane is then removed entire from the vaginal edge of the opening; the blade of the knife should cut in an oblique direction, and not touch the vesical mucous membrane, as an injury to it will inevitably lead to copious bleeding (Fig. 245, A, B). Some operators use scissors, and a combination of both instruments may be necessary in order to obtain a raw surface. Any hæmorrhage is checked by the intermittent hot douche and the pressure of small sponges on holders.

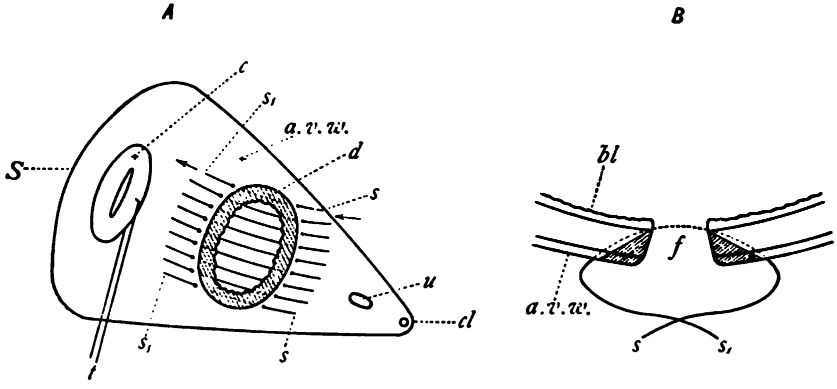

FIG. 245.—Mode of passing sutures in vesico-vaginal fistula. A. As seen in semiprone position. S, Sims' speculum, blade in section; *c*, cervix, secured by tenaculum *t*; *a.v.w.*, anterior vaginal wall; *d*, denuded surface; *ss*, *ss*,, 1st and last of series of sutures; *u*, urethral orifice; *cl*, clitoris. B. As seen in section. *bl*, bladder mucous membrane; *a.v.w.*, anterior vaginal wall; *f*, fistulous opening; *ss′*, suture passed but not tied. The shaded areas denote amount of tissue removed in denudation process.

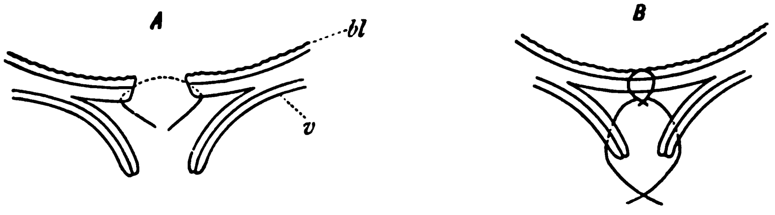

FIG. 246.—Mode of freshening the edges of a fistula by "flap-splitting." A. Flaps split and deep suture passed but not tied. *bl*, Bladder mucous membrane; *v*, vaginal mucous membrane. B. Deep suture tied and superficial one passed.

Another mode of freshening the edges is by the process of *dédoublement* or flap-splitting (Fig. 246, A, B); it is useful when the vagina is narrow, and there is not sufficient redundant tissue to make satisfactory flaps. The raw surface is produced by splitting up the edges of the fistulous openings, so that the mucous membrane of the bladder and vagina are separated all round; the flaps are brought together separately by fine silk.

Passing and securing the sutures.—The needle is first double-threaded with carbolised silk; a tenaculum seizes the most inaccessible point of the denuded surface, and places the tissue on the stretch. By means of the holder the needle-point is entered on the vaginal surface, about one-third of an inch from the raw edge, passed obliquely (Fig. 247) through the tissues, and brought out at the bladder orifice of the fistula; great care being taken to avoid the bladder mucous membrane. The needle is then entered again on the opposite side of the bladder opening of the fistula, and passed obliquely through the tissues; it emerges on the vaginal mucous membrane about one-third of an inch from the raw edge, and as nearly opposite the site on the other side as possible. Care must be observed not to make the point of entry of the needle more than half an inch from the raw edge, as the ureter may otherwise be included in the ligature. The wire suture, about ten inches long, is now hooked into the silk loop and pulled through.

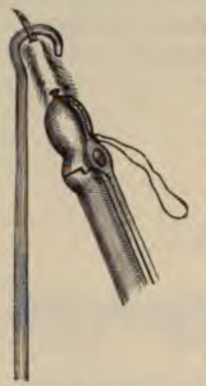

FIG. 247.—Mode of applying counter-pressure to the point of the needle by means of a blunt hook (Emmet).

In order to produce counter-pressure on the tissues against the needle-point, Emmet's blunt hook is used as in the diagram (Fig. 247). Care should be taken to include sufficient tissue in the sutures. A series of these are now passed in a similar manner about one-fifth of an inch apart. The two ends of the silver wire are now twisted together by means of forceps and a Sims' adjuster or shield (Fig. 244)—an instrument devised for accurate adaptation of the flap without producing torsion upon the tissues (Fig. 248). Chromicised catgut sutures may be used instead of silver wire. It must be ascertained that the denuded edges are in accurate apposition, by inspection and by the injection of boric lotion into the bladder. Should the fistula be quadrilateral in outline the resulting cicatrix will be found to be Y-shaped; if oval, a transverse or longitudinal line will result. Sims' sigmoid catheter (a self-retaining instrument) with a long piece of india-rubber tubing attached may be introduced, and the patient put back to bed.

The two chief complications to be encountered are hæmorrhage into the bladder and cystitis. The catheter should be changed daily, replaced by a second, and thoroughly cleansed before being used again. It is better for the tube to open into a deep dish filled with a 1 in 60 carbolic acid lotion. No other local treatment is necessary. The stitches may be removed about the tenth day.

When the fistula is close to the cervix, it is better to incise the anterior cervical lip or to excise a wedge-shaped piece to allow of free inspection and access. The denudation should then be freely made around, and, in case of tension, liberating incisions are advisable; the sutures should then be passed as before.

In urethro-vaginal fistula the edges are denuded and sutures passed, as in the manner just described.

Until recently vesico-vaginal fistulas of large size, with adherent edges and in positions difficult of access were, as a rule, treated by the procedure called *kolpokleisis*, or closure of the vagina below the fistulous opening. Fortunately this is now rarely required as, in consequence of the ingenuity of various operators, almost every kind of vesico-vaginal fistula can be successfully closed.

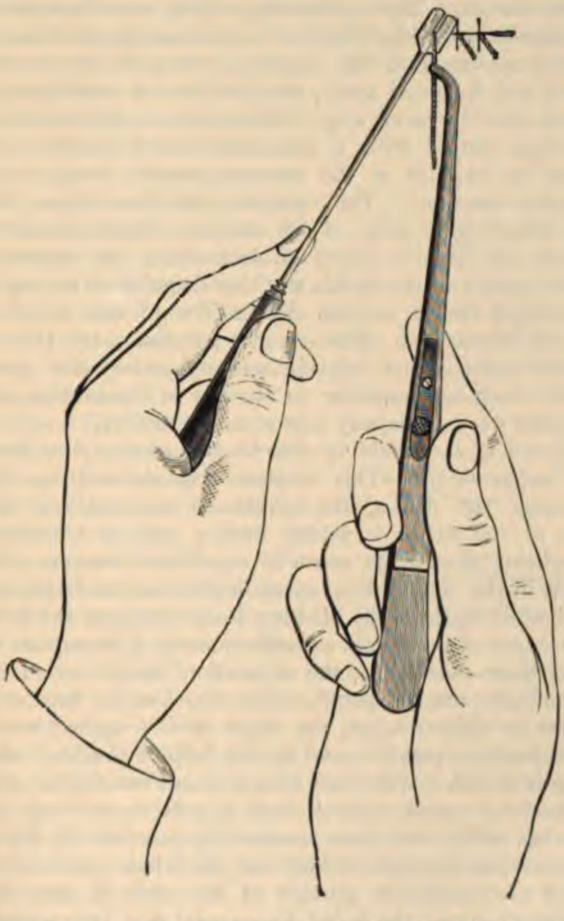

Fig. 248.—Method of fixing and twisting the sutures (Sims).

(i.) *Closure of the fistula by turning up vaginal flaps to form the base of the bladder.*—This operation was first performed by A. Martin of Berlin, who, as a preliminary, freed the adherent edges of the fistula, and then raised flaps of the vaginal wall and brought them over the opening, carefully suturing these together. By this means the vaginal mucous membrane formed the new bladder lining, and the exposed raw surface the anterior vaginal wall. The edges of the latter were then united by a continuous suture, as in the operation of colporrhaphy.

(ii.) *Closure of the fistula by suturing the denuded vesical mucous membrane to its anterior margin.*—This proceeding, which was first carried out by Dudley, is thus described by him:—"In the case operated upon the entire vesico-vaginal septum and the vaginal portion of the cervix with its anterior wall had sloughed away, and the tissues could not possibly be drawn together in the usual way. The mucous membrane of the bladder, however, when caught with a tenaculum could be drawn forward to the neck of the bladder at the extreme anterior margin of the fistula without undue traction. The operator therefore began to close the fistula by denuding a strip of the mucous membrane surface of the bladder from side to side, about an inch above the posterior opening. The anterior margin of the fistula was now denuded of its vaginal surface, and the denuded vesical mucosa drawn forward and attached to it on two sides by twenty-two silkworm-gut sutures. By this remarkable procedure the vesico-vaginal septum was replaced by that portion of the bladder wall which lay posterior to the line of denudation, and the new bladder formed was in this way just so much smaller."

(iii.) *Closure of the fistula by detaching the bladder from the vagina and suturing it independently.*—This method was devised by Mackenrodt. After exposing the fistula, the cervix at one end and the urethral prominence at the other is seized with a pair of tenaculum forceps, the tissues being thus made tense in opposite directions. An incision is then made in the median line, extending across the fistula and through the vaginal walls down to the bladder, so as to expose the entire bladder base. The edges of the fistula are subsequently split, so that the bladder is separated from the vagina, the separation being carried if necessary through the vesico-uterine pouch. The two bladder flaps are now carefully sutured by silkworm-gut, the edges of the vaginal wound brought together as much as possible, and by the help of the body of the uterus the opening is closed. Kelly describes a somewhat similar operation.

(iv.) *Closure of a vesico-vaginal fistula by suturing the body of the uterus into the opening.*—This has been successfully practised by Freund in two cases. In one case the patient had lost the whole posterior wall of the urethra, and a considerable portion of the neck of the bladder; the fistula easily admitted the index finger, and was surrounded by much scar tissue. Douglas's pouch was first opened, the retroflexed uterus pulled down into the vagina, and both sides in front of the broad ligaments scraped until they bled. The raw edges of the opening in the bladder were then sutured to the posterior half of the uterus. The fundus uteri was then removed so as to expose its cavity, and the edges of the wedge-shaped excision united, providing an exit for the menstrual discharges. The result of this operation was practically successful.

II. Fistulas requiring Special Treatment.—1. In *vesico-utero-vaginal* or *juxta-cervical fistulas* the cervix is involved, and must be distinguished from the vesico-vaginal variety, in which the cervix is intact. They are subdivided into superficial and deep according to the partial or complete sloughing of the anterior cervical lip.

In the superficial form much may be done by simple denudation and suture; the tissues being extremely tough from cicatrisation, the freshening must be extensive, as a healthy, broad, and pliable surface is more easily sutured than a cicatricial and inelastic one (Fig. 249). In order to obviate the difficulty of the scar tissue, the plan recommended by Wölfler should be carried out. The cervix is drawn downwards and backwards by volsellæ and the anterior cul-de-sac incised. If this incision be extended upwards the bladder and its fistulous opening will be separated from the cervix with its opening. The edges of each should be carefully pared and then sutured. If necessary the vaginal vault may then be closed by sutures.

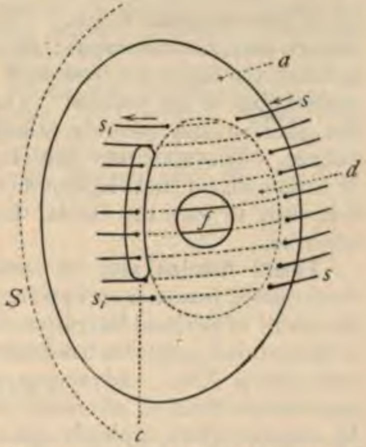

FIG. 249.—Juxta-cervical fistula (superficial variety). *S*, Sims' speculum in section; *f*, fistula; *d*, denuded area; *c*, cervical canal; *a*, anterior lip; ss_1, ss_1, series of sutures passed.

Deep juxta-cervical fistulas are very rarely amenable to treatment by suture, and it is generally necessary to resort to abdominal section as recommended by Trendelenburg. The patient is placed in the dorsal decubitus with the pelvis raised to an angle of at least 45 degrees. By this means immediately the bladder is opened it becomes filled with air, and the whole interior is freely exposed to inspection. A transverse incision is made across the upper border of the symphysis pubis, the attachments of both recti are cut through, and the prevesical space opened. The bladder wall is then incised transversely. The edges of the fistula are now exposed, and should be denuded "in the form of a shallow funnel in such a way as to remove a broad band of tissue from the bladder mucosa, and a narrow one from the vagina and cervix." The edges are brought together with silkworm-gut sutures, two needles being threaded on to one suture, both ends being passed into the vagina and tied there. After closure and drainage of the bladder the patient is placed in Sims' position until the fifth day. Two out of four cases recorded were successful.

2. *Vesico-uterine fistula.*—The best method of operation for this complication is that described by Champneys. After the usual preparation a bent probe is introduced through the urethra, and passed on directly into the cervical canal. The cervix is then steadied by the application of a volsella, a transverse incision is made through the

anterior fornix, and the bladder dissected up from the anterior cervical wall by means of scissors and the fingers, as in vaginal hysterectomy. Care must be taken to take the dissection well above the orifice of the fistula; no further dissection is required. Silver sutures are passed from side to side to close the opening in the bladder, care being taken to avoid the mucosa, and four similar sutures are passed to close the cervical orifice, these being cut short. Finally the vaginal wall is united to the cervix by four long silkworm-gut sutures, a self-retaining catheter is introduced into the bladder and the vagina packed with gauze.

3. *Uretero-vaginal and uretero-uterine fistulas* are frequently complicated by a vesico-vaginal fistula. These fistulas are now usually treated by uretero-vesical anastomosis; the proximal end of the ureter having been isolated, the edges are freshened and an oblique opening made into the nearest part of the bladder. The end of the ureter is then passed into the bladder and securely attached to the muscular coat by fine silk sutures. The operation may be performed per vaginam if the fistula is accessible, if not laparotomy will be required. When this operation fails to cure the fistula, the kidney of the affected side should be removed.

Fæcal fistulas may be recto-vaginal, entero-vaginal, or recto-labial. *Recto-vaginal* fistula is an opening between vagina and rectum, and may be the result of perineal laceration during parturition, when the lower portion of the sutured perineum has healed after suture, but the upper still remains open (see p. 728). Advancing malignant disease, rupture from abscess, and various kinds of ulcerative processes, may also lead to this condition. In cases in which a plastic operation is advisable, should the opening be low down, it is better to cut through the perineum and re-suture the two flaps after the manner already described in complete perineal rupture (p. 817); if the orifice be higher up, denudation should be carried out over an area around it, and sutured as in vesico-vaginal fistulas.

JOHN PHILLIPS.

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J. P.

OVARIOTOMY

History.—The history of ovariotomy is a remarkable and fascinating one. Attempted by several surgeons nearly a hundred years ago, and even successfully carried out in 1809 by Dr. M'Dowell in America, it is less than fifty years since it became one of the recognised operations of surgery. During the earlier part of this period, before the principles of asepsis were at all understood, the dangers of the operation were so great and so alarming that special qualities were needed in those who essayed the surgical treatment of ovarian tumours and fought their way, in spite of unintelligible dangers and disasters, to comparative success. For this reason the names of Spencer Wells in London, of Keith in Edinburgh, of Clay in Manchester, and of Lawson Tait in Birmingham are deservedly honoured and remembered, not only as those of great men who were pioneers of surgery, but also because the work done by them as gynæcologists has led the way to all the modern developments of abdominal surgery. Looking back we recognise that there was something strikingly anticipatory or almost prophetic in their work. They divined the possessions into which we have entered while as yet they were afar off, and attained to a very large extent the practice of aseptic surgery before the principles on which this rests were really discovered or understood.

But two other names connected with this period deserve perhaps higher honour—those of Pasteur and Lord Lister, for they, by their experimental and original work, gradually established the knowledge of the important part played by micro-organisms in the production of disease, became the fathers of modern bacteriology, and enabled us definitely to understand, for the first time, the precise reason of success and failure. During the latter part of the period I am considering, the work of the bacteriologist has steadily grown side by side with the work of the ovariotomist, and it is emphatically to the science as well as the art of surgery that we owe our present attainment.

Two surgical methods unknown to our predecessors have gradually grown in favour during recent years, and are so far accepted as to influence materially the operative surgery of the ovaries and Fallopian tubes. The first of these is vaginal section leading to vaginal ovariotomy, the second is the Trendelenburg position as an accessory in intra-abdominal work. Both of these methods have very largely revolutionised the practice of pelvic surgery; but, apart from these changes, the history of ovariotomy during the last twenty-five years has been rather one of increasing knowledge of operative pathology, increasing certainty as to the value or uselessness of operative methods, and increasing attention to eclectic detail rather than one of any startling change in practice. The scope of operative work has widened, and the performance of ovariotomy and allied operations has been almost perfected.

The death-rate is still difficult to estimate. In ovariotomy pure and simple (excluding tuberculous and malignant cases) the mortality should be practically "nil." In ovariotomy with no exclusion, comprising under the term all operations on the ovaries, tubes, and broad ligaments, the mortality is from 4 per cent to 9 per cent; the cases of death being mainly due to pre-existing malignancy, tubercle, sepsis, or systemic disease.

Acute post-operative sepsis should now be extremely rare or even unknown. Chronic post-operative sepsis is sometimes met with, and is responsible for an occasional death and for some retarded recoveries.

One hundred and thirty-eight cases of large ovarian tumours (every one of which was examined microscopically) are thus tabulated by Prof. Howard A. Kelly of Baltimore (in his operative gynæcology).

Multilocular adeno-cystoma	57
Unilocular adeno-cystoma	3
Adeno-papilloma	27
Adeno-carcinoma	9
Sarcoma	2
Fibroma	4
Dermoid cysts	26
Parovarian cysts	10

The numbers given in this table probably indicate very closely the proportions of the varieties of ovarian tumour. Ovariotomy for large tumours may be abdominal or vaginal, but the field for vaginal ovariotomy in this sense is very limited. "Ovariotomy," in the wider sense, as used by Greig-Smith in the former article on this subject, and held to include the surgical treatment of many diseases of the uterine appendages and broad ligaments when no large tumour is present, may very often be most wisely approached by vaginal section only. Abdominal and vaginal methods of operating for such diseases will be discussed after describing ovariotomy for larger tumours.

Preparatory Measures. — Most of these are fully described in a previous article (p. 751). It may be noticed, however, that as the infinite importance of asepsis is more fully realised, so all that makes for this end rises in value; and though it may be possible to ensure aseptic surgery in almost any house and under any circumstances, yet the comfort and safety of aseptic rooms, furniture, and appliances, as provided in a well-arranged hospital or nursing home, makes such a place most desirable for the performance of the operation.

The surgeon himself should, if possible, visit the patient the day before the operation and obtain the very latest and fullest information regarding the case by a detailed and complete examination. When the tumour is left-sided or there is any reason to suspect that the rectum may have special relations to it, a careful rectal examination should be made. Information of vital importance may sometimes be obtained by this.

The nursing-room should be large, light, airy, and thoroughly well heated, without draughts or smoke. If possible, it should have been recently cleaned throughout, and all superfluous furniture removed from it. No drain from bathroom or otherwise should communicate with the room or its vicinity. The room is kept sacred to the treatment of the case. Unless the case be hopeless, no one is admitted except the nurses and the doctor. After four days, if doing well, the patient is allowed one visitor daily.

Two nurses—a day nurse and a night nurse—are required during the first week. After this, one nurse is usually sufficient. The bed should be a single iron bedstead with woven wire mattress. On this there should be a good hair mattress and absolutely clean bed-linen and blankets. A feather bed is inadmissible. If the patient be able to take it, she should be given a good light supper the evening before operation, and a mild aperient afterwards. She is then encouraged to sleep until the morning. At 4 or 5 A.M. she may be given some beef tea or hot milk, but nothing after this until the operation is over.

At 7 A.M. an enema is given, when the bowels should be thoroughly emptied.

9 A.M., or before this, is the best time for the operation.

The nurse should dress the patient in the following manner:—A pair of clean, warm woollen stockings should clothe the feet and legs. A short, clean woollen vest should clothe the chest and upper abdomen.

A clean nightdress should be worn above this, and in cold weather it is often advisable to wear a short dressing-jacket over all.

Arrangements for Operation.—The usual placing of the table, surgeon, and assistant is shown in the accompanying diagram (Fig. 250). The patient's feet are towards the window or chief light. The surgeon stands on the patient's right; his assistant—only one operating assistant is necessary—opposite to him on the patient's left. Two nurses are in attendance: one stands behind the assistant, takes the sponge-pads from his hand, cleanses them, and returns them clean if needed for a second use; the other has charge of a small steriliser and hands to the surgeon the sterilised silk—or sterilised needle and silk already threaded—as needed for ligature or suture. This nurse also has charge of the drainage-tubes and sterilised iodoform gauze (Linton), and holds herself in readiness to supply any length or size which may be necessary for intra-abdominal drainage. The instruments when lifted from the steriliser are placed on a tray or trays and covered with boiling water, close to the surgeon's right hand. The surgeon should help himself to instruments—an assistant to hand them imports another risk and is quite superfluous. In operations of emergency at the patient's house, the work of both the assistant nurses may often be dispensed with. The operation-assistant (whether male or female) carefully husbands the use of the sponge-pads, so as to make the original quantity exactly last the need of the operation, while the surgeon arranges his steriliser and gauze by the side of his instrument-tray and helps himself to needles, silk, and gauze, as well as to other instruments. When the instruments are boiled in a towel, the towel may sometimes with advantage be spread open on the surface of a clean table (without any containing tray), and from this the instruments can be taken with perfect safety.

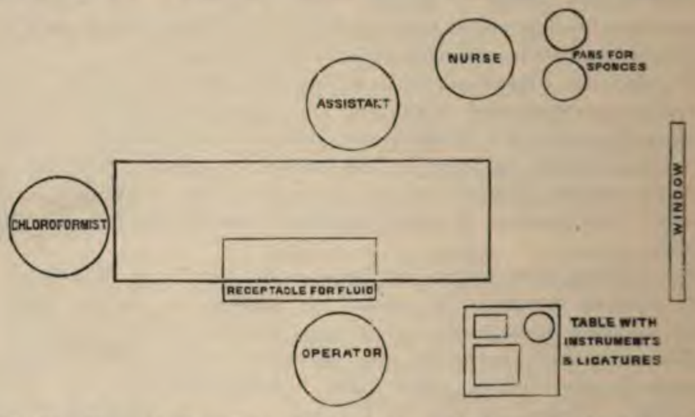

FIG. 250.—Diagram to show placing of table, surgeon, assistants, nurse, and instruments in ovariotomy. (*After Doran.*)

If the Trendelenburg position be desired, the patient must lie with her head towards the main light, unless there is a good opposing light in the operating-room. The best arrangement for this involves a corresponding reversal of position for every one concerned (Fig. 251). The Trendelenburg position is so generally useful that many surgeons now are in the habit of operating with the patient's head towards the main light, but with no elevation of the pelvis, so as to be in readiness for raising the pelvis if this necessity arises. This position, however, is not to be recommended for the initial steps of an ovariotomy with a large abdominal tumour and with little or no cross light, as the usual incision-site is then in almost complete darkness.

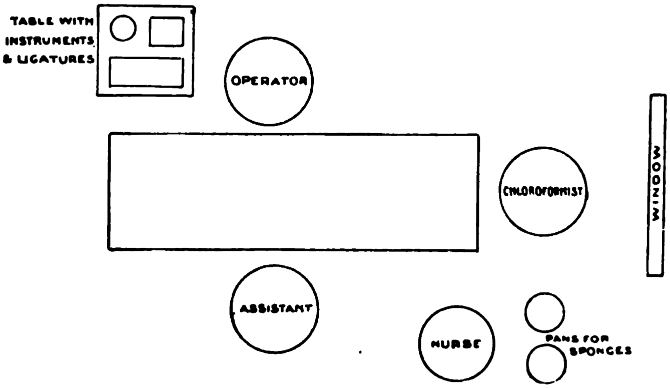

FIG. 251.

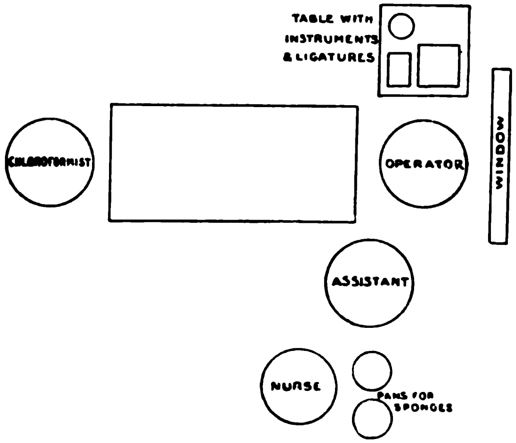

FIG. 252.

The vaginal operation—or posterior vaginal cœliotomy for drainage—demands a different placing (Fig. 252); that is, the surgeon sits, with his back to the main light, facing the end of the operating-table; on his right is a low instrument-table, on his left the basin or sponges. The chief nurse stands on his right and hands him sterilised ligatures and sutures. The operation-assistant stands on his left and has charge of the sponging.

The conduct of most cases of abdominal section may be advantageously prefaced by vaginal sterilisation and a full bimanual examination under anæsthesia, so that I usually begin gynæcological abdominal sections by some work (not necessarily operative) in the vaginal position, and pass from this to the first or second abdominal position.

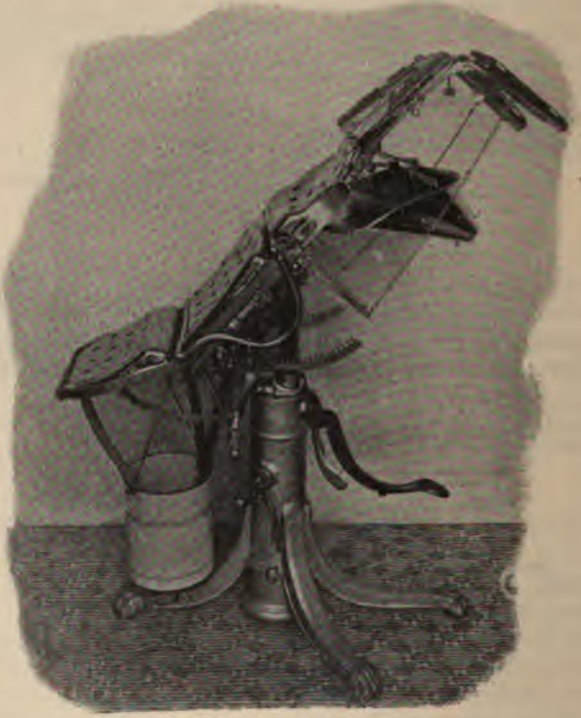

Fig. 253.

An operating-table with central stand easily admitting of circular movement in a horizontal plane, as well as of raising and lowering movements, is of decided advantage in facilitating the best operative work.

The best table of this kind is undoubtedly that of Dr. Doyen

(Fig. 253), but there are others possessing very similar advantages which are much less expensive. The table of Professor Hahn admits of all the necessary movements, and can be thoroughly recommended (Fig. 254).

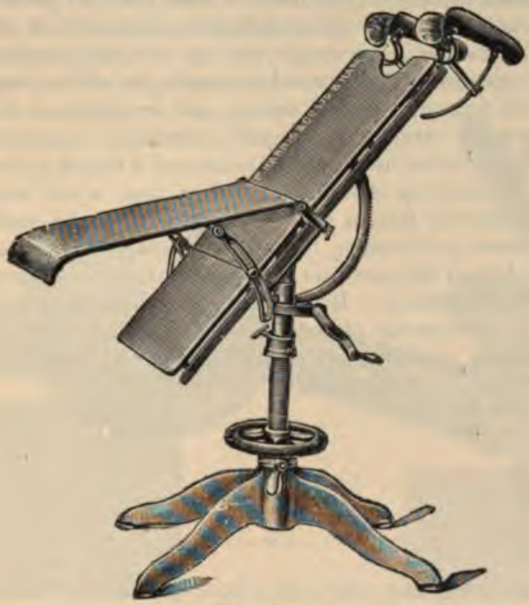

Fig. 254.

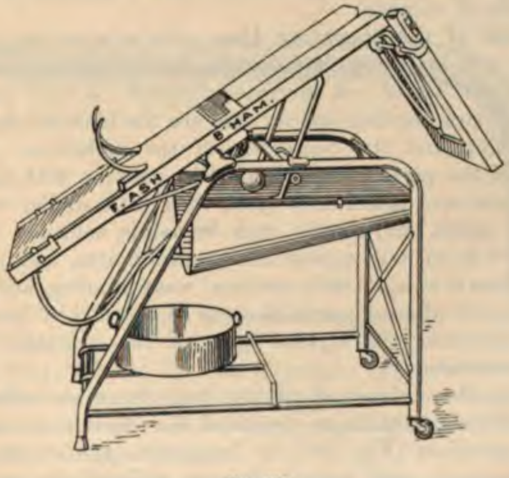

Fig. 255.

Another table which I have found useful in practice is the "Counterbalance Operation Table" (Fig. 255). This has no "pivot" action, but can be made to assume the usual different positions with great ease and comfort. The mechanism is simple and the cost very moderate.

Artificial Sponges.—These are best made by sewing together layers of gauze in the form of a perfect square, and are prepared in quantity by the manufacturing chemist or aseptic instrument manufacturer. The sizes I have found most useful are 6 inches and 9 inches square (Fig. 256). They are soft, soak up discharges readily, and when well made and properly sterilised are safe in use. The number to be sterilised should be counted before sterilisation, the number used at the operation counted when removed from the steriliser before operating, and counted again at the close of the operation. If necessary, these operation-numbers should be checked by the number of "sponges" remaining in the steriliser and the total number sterilised. Useful numbers for operative work are 7, 9, 12, 18, and 24. It is advisable for the surgeon to keep to an invariable series of numbers.

FIG. 256.

Preparation of the Operation Area.—As soon as the patient is unconscious, the hair is cleanly shaved and all the operation area scrubbed with soap and hot water. A sterilised "loofah" is very useful for this purpose. The parts needing special care are the folds of the skin at the vulva, the groins, and the depression of the umbilicus. The soap is washed off and the parts further cleaned by rubbing with sterilised wool soaked in a 2 per cent solution of lysol, then with similar swabs soaked in methylated spirit, and finally with biniodide solution. The clothes are removed, so as to well expose the operation area, and over these are arranged (*a*) clean towels, (*b*) thin sterilised waterproofing, and (*c*) sterilised towels covering all adjacent parts likely to be touched by hands or instruments, and restricting the exposed part of the operation area to the vicinity of the incision.

In cleaning the vulva and vagina, the threefold method of lysol, spirit, and biniodide solution, as described for the skin, is used by means of Auvard's speculum (Fig. 257) to keep the vagina open, volsella to draw down the cervix, and suitable forceps to hold the wool soaked in the different solutions. The anterior and posterior vaginal vaults (particularly the latter) need especial care, and the cervix must be depressed or elevated, in order to visibly carry out the process of disinfection. The spirit should be well used in cleaning the vulva and surrounding parts, but may sometimes be advantageously omitted in the preparatory toilet of the vagina itself.

Instruments.—The only special instrument absolutely necessary in ovariotomy is the ovariotomy trocar, and the simplest form of this in metal or glass, similar to that first introduced by Mr. Lawson Tait, is undoubtedly the best (Fig. 258).

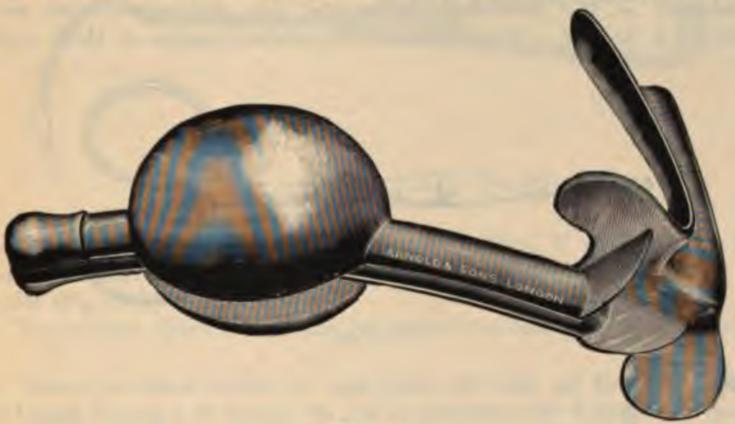

FIG. 257.

The armamentarium should include:—Two scalpels with fine edge; one pair of sharp scissors; twelve hæmostatic pressure-forceps; four large forceps with long "elastic" blades (Doyen); two ovariotomy trocars—large and small; one handled pedicle-needle, blunt-pointed; one handled suture-needle; one sound; two volsellæ; one long-handled scissors curved on the flat; Auvard's speculum.

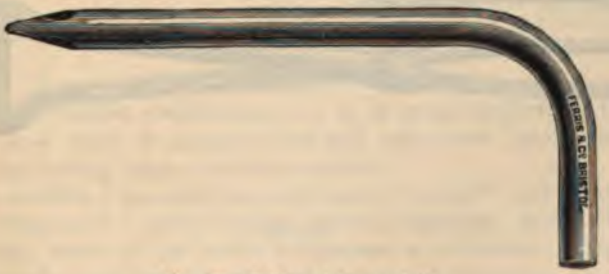

FIG. 258.—Tait's cyst-trocar; ½ size.

Ordinary surgical needles of various sizes, silks corresponding, and a bottle of moist iodoform gauze (Linton) are among the essential accessories. In addition, it is well to have in reserve a second dozen of pressure-forceps, a curved trocar (sharp-pointed) and cannula, or a large exploring-needle, a thermo- or electric cautery, and a few drainage-tubes of different sizes in rubber and glass.

The instruments, in trays and covered with boiling water, should be arranged in groups and so placed that the surgeon can put his hand in a moment on the instrument he wants. An instrument after use is replaced in its tray. The trocars, with suitable lengths of thick rubber tubing attached (so that the fluid may be carried from the tumour to a vessel underneath the operating-table), are placed in a special large basin or taken directly from the steriliser.

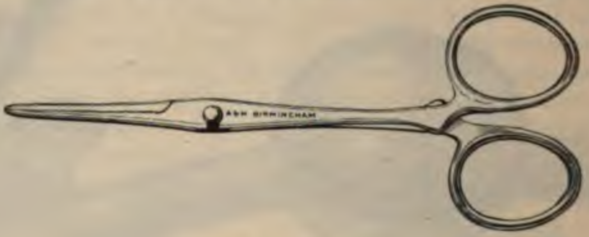

FIG. 259.

The hæmostatic pressure-forceps are made of various shapes. Two of the best are those of Greig-Smith and the longer-bladed forceps (Fig. 259). The latter are more generally useful—these forceps serving not only to compress cut vessels, but also to seize the collapsing cyst, and to hold small needles, as in suturing the peritoneum and fascia of the abdominal wall. The larger, but delicate, "elastic" forceps (of Doyen) (Fig. 260) may be used as cyst-forceps for the extraction of the cyst, or as clamping forceps for closing the trocar-puncture, or as lightly compressing forceps for controlling the circulation in the broad ligament or omentum, or for clamping intestine should resection of bowel be required in the course of operation. The blunt-pointed pedicle-needle is made in two forms, the straight and the angular—the one with the

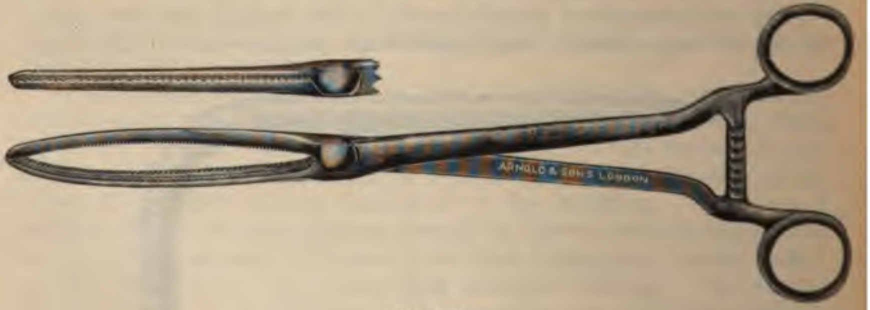

FIG. 260.

right-angled bend is more serviceable (Fig. 261). It should have one eye only, and this should be near the point of the instrument. An ingenious pair of forceps was devised by Greig-Smith to take the place of the pedicle-needle in the passing of a ligature. This, if preferred, is also more serviceable when made with a right-angled bend like that of the needle (Fig. 262).

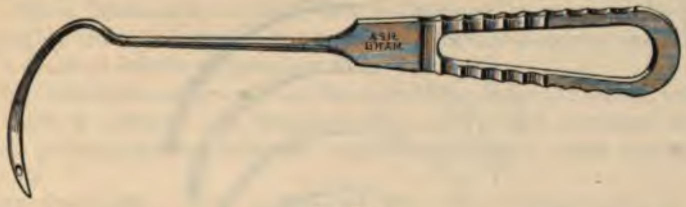

FIG. 261.

The scalpels should, of course, be made from one piece of steel, so as to admit of perfect sterilisation. It is of prime importance that these should be as sharp as possible, finer and safer work being done with a scalpel the cutting edge of which is perfect.[1]

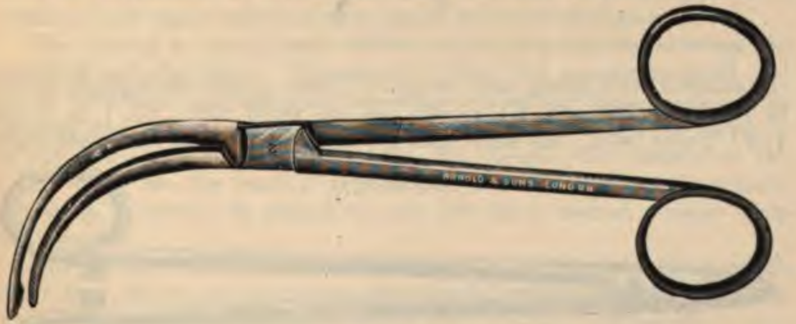

FIG. 262.

The needles I generally use are made "curved" and "half-curved" with a "Hagedorn" point or slight cutting edge (Fig. 263). The upper part of the shaft of the needle is flattened in a direction at right angles to the blade of the point, so that no special needle-holder is required, but the needle can be passed by the ordinary needle-holder (Fig. 264) or by the hæmostatic compression-forceps. The silk should be as fine as is consistent with safety, and excess of tissue in any one ligature should be avoided. The sizes I generally use are ·0000, ·000, ·00, 1, 2, 3, and 4 of Chinese twist; the finer sizes are used for suturing the peritoneum or fascia and for the ligation of small vessels. The larger sizes—all, however, relatively fine—are used for the ligature of the pedicle or broad ligament. It is to be noted that all of these silks can be sterilised by half an hour's boiling in a weak solution of the red iodide of mercury; and all, if sterile, are in time absorbed.

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[1] The art of sharpening a knife or razor should be acquired by the surgeon. One very good method is as follows:—A fine close-grained stone (Arkansas stone) is used, and the surface of this having been lightly oiled, the knife or scalpel is held with the edge at an acute angle to the surface and drawn firmly from heel to point diagonally across the stone; the blade is then reversed, held at a similar angle to the stone on this opposite side, and drawn from heel to point, but in the opposite direction. The repetition of these alternate movements should bring the edge of the knife to the condition of a mathematical line between two points. This is the first stage of sharpening. The second stage is rather one of polishing. The knife is held almost flat, and carried from point to heel across a leather strap and away from the edge, first on the one side and then on the other (reversing the action in the first stage), until the edge is perfectly keen throughout.

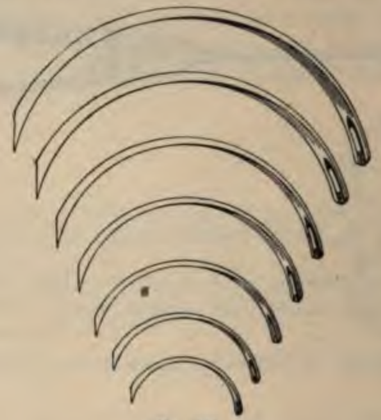

FIG. 263.

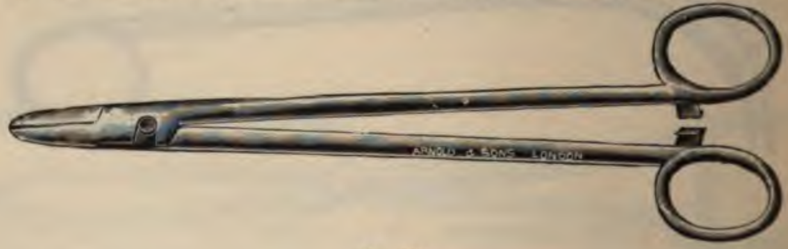

FIG. 264.

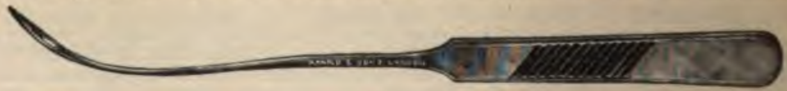

FIG. 265.

The handled needle for the passage of silkworm-gut sutures should be of this shape (Fig. 265). Except when the parietes are very fat, it is carried through both sides of the incision with one thrust; the point of the needle is then threaded with a strand of silkworm-gut by the assistant, and the suture is placed by the withdrawal of the needle.

Drainage-tubes in modern ovariotomy have almost disappeared from use. When drainage is required, this is obtained by opening the pouch of Douglas from the sterilised vagina and lightly plugging the opening with a drain of iodoform gauze (p. 871).

The instruments mentioned at the close of the list—the sound, volsella, long-handled scissors, and speculum (Fig. 257)—are intended for use in the performance of posterior vaginal cœliotomy when drainage is advisable.

The Operation.—This is prefaced, as I have already said, by a bimanual or vaginal examination under anæsthesia, and then by a thorough disinfection of the vulva, vagina, and operation area. Previous to this the hands and arms of the surgeon, assistant, and chief nurse are sterilised (see article "Antisepsis and Asepsis"), and the method which has given me (personally) the best results is that introduced by Prof. Kelly of Baltimore, in which saturated solutions of permanganate of potassium and oxalic acid and methylated spirit are essentials.[1]

The incision is usually made in the middle line, midway between the umbilicus and the pubes. Occasionally, when the tumour is small and on the right side, and there are reasons for expecting the appendix to be inflamed and adherent, it is better to operate by an "appendix incision" on the outer side of the rectus. By this incision the pedicle of the right ovary can be readily approached and divided; it is usually impossible, however, to attend to any left-sided ovarian disease from this situation.

The operation in the median line was well described by Greig-Smith in the first edition of this *System*, and the following, taken largely from this source, must be regarded as the product of a joint authorship.

The first cut usually divides the skin and fatty tissue down to the fibrous aponeurosis. In very stout persons the fatty layer may be several inches in thickness, and this may be further increased by œdema. In very thin persons, with distended abdomen, the subcutaneous fat may be absent. Catch-forceps are placed on bleeding points: these may be removed as soon as the cavity is opened; in a few seconds hæmostasis will be complete and permanent, and ligatures will be unnecessary.

The fibrous aponeurosis is next divided as nearly as possible in the linea alba. A glance at the arrangement of the fibres will often, by their symmetrical arrangement on the two sides, show the exact middle line; but frequently the linea alba is not hit off, or not divided at all, but one or other sheath of the rectus is entered. In persons with powerful recti and not very distended parietes, the linea alba may be no more than a thin fibrous septum; in women with thin or distended parietes the linea alba may be broad, and then there will be no difficulty in avoiding the recti. But to expose either or both muscles does no harm; indeed, some surgeons say that to expose muscle and bring it into the line of union is a distinct advantage, as it helps to prevent ventral hernia. There is certainly no advantage in being far from the middle line; if the sheath be opened it should be close to the linea alba. A small cut is made with the scalpel through the thick aponeurosis; a glance will show whether it is far from the middle line, and on which side; it is then extended upwards and downwards towards the middle. Below the falciform edge, where most operations are done, there is no more aponeurosis to divide; above this level the walls of the sheath of the rectus remain to be divided.

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[1] Method of sterilisation of hands now in use at the Hospital for Women, Sparkhill, Birmingham, by order of the Medical Board:—

1. Scrubbing with hot water, soap, and sterilised hand-brush for not less than five minutes.
2. Attention to nails.
3. Staining in hot saturated solution of permanganate of potash. Bleaching in hot saturated solution of oxalic acid.
4. Rinsing in hot running water.
5. Rubbing in methylated spirit.
6. Washing in hot running water.

The subperitoneal fatty and areolar tissue is now exposed. It is naturally very loose and elastic, and it can readily be teased apart so as to expose the underlying peritoneum. Occasionally it is very sparse in amount; sometimes it is thickened and hardened by inflammation, and firmly adherent both to peritoneum and to muscle. The fat is pushed to one side and the other, and a minute portion of peritoneum is caught up in catch-forceps and pulled to the surface. A second forceps is placed close to the first by its side; the minutest grip suffices to give a hold. Between the two pairs of forceps the raised fold is gently sawed through by a knife, air rushes in, the bowels fall back, and the opening is enlarged to a size sufficient to admit the forefinger. The left forefinger is introduced through the opening, and the peritoneum divided on it upwards and downwards to the full extent of the outer incision by scissors; or two fingers of the right hand may be introduced (palmar-side upwards) to keep back the intestines, and the abdominal wall divided by the scalpel between the opened fingers. Any small vessel which bleeds is at once seized in catch-forceps, which are left hanging for a few seconds, or till after the cyst is emptied.

In ovariotomy the incision has rarely to be increased beyond a length of four or five inches. If the incision has to be carried above the umbilicus it should be carried to the left of it; this is done to avoid the round ligament of the liver and the thin tissues—not suitable for holding sutures—in the umbilicus itself.

On opening the abdomen a glance at the condition of matters within it will often tell much to the experienced surgeon. If the tumour be white, glistening, and not adherent, it is a simple ovarian cyst; if it be pinkish with a double layer of vessels coursing over it, it is probably parovarian; if it be hard and pinkish, it is a myoma; if black with contained blood, it is a case of twisted pedicle or extra-uterine pregnancy.

If there be much ascitic fluid present, he may suspect tubercle, papilloma, malignancy, or rupture of the cyst; the appearance of millet-seed granules covering the peritoneal surfaces is pathognomonic of tubercle.

When the peritoneum is inflamed, it is sometimes greatly thickened, so that a hard potato-like substance of some $\frac{1}{8}$ of an inch or more may need division before entering the abdominal cavity. This condition needs careful differentiation from the artificial thickness caused by adherent tumour or bowel.

When the peritoneum is very difficult to find at the site of the original incision, it is often better to try another point higher up than to persevere in a deep and doubtful dissection. When the parts are adherent at the site of the incision, considerable judgment, experience, and skill may be required in this finding of the peritoneal cavity. Sometimes the peritoneum has been stripped from the parietes in the belief that the tumour was being stripped from peritoneum. An inflamed and thickened peritoneum is usually vascular and somewhat friable.

Emptying and Delivery of the Cyst—Separation of Adhesions.—The tumour being exposed, and found cystic and suitable for removal, is usually tapped at once. In a few cases where the surface of the cyst is lightly adherent all over the anterior abdominal wall (as in some tumours with a moderately twisted pedicle), it is wise before tapping to separate the adhesions by passing the right hand over the whole surface of the cyst, between this and the peritoneum of the abdominal wall, while the cyst is still firm and tense; but in most cases as soon as the cyst-wall is exposed it may be tapped.

A point for inserting the trocar should be selected in a large and thick-walled cyst; small thin cysts and the sulci between them should especially be avoided. A very small linear incision is then made at this point with a sharp scalpel through the outer layers of the cyst wall, but not opening the cyst cavity; Tait's larger trocar is then plunged through the incision into the cyst, fluid flowing at once through the rubber tubing into the receiver.

Almost simultaneously the cyst-wall below the trocar is grasped with cyst forceps and is pulled to the surface. Deft manipulation will always avoid the escape of fluid into the peritoneal cavity, and will bring the rapidly collapsing cyst-wall outside the parietal incision. The parietes are not pressed back on the cyst; rather is the cyst pulled outwards and on to the parietes. A second pair of forceps, placed on the cyst above the trocar, during the emptying, suffices to hold the opening in the cyst outside the wound and perhaps to deliver the whole tumour.

Delivery may be prevented by the presence of semi-solid polycystic material in the growth, and by adhesions. Secondary cysts should be emptied one after the other by pushing the trocar into them. If they are very closely set and very numerous, or if the contents be foul or of a dermoid character, it is better at once to enlarge the abdominal incision, so as to admit of immediate removal of the tumour. The fluid having ceased to flow, the trocar is withdrawn and the opening in the cyst immediately clamped by the larger "elastic" forceps, or by two pressure-forceps. The cyst is pulled out of the abdomen by the hands or forceps, and as it comes outside a large sponge is placed immediately above the pedicle to keep the intestines from protruding and the pedicle unsoiled from any discharge above it.

If delivery is prevented by adhesions, these are now dealt with. Distant parietal adhesions are separated by the hand. Omental adhesions are sponged off from the surface of the tumour or ligatured, and then divided. When adhesions are sponged off, there is often some bleeding from the site of the adhesion, though there may be no visible loss of tissue, and either pressure-forceps must be left on for some five or ten minutes or a fine ligature applied before returning the recently adherent omentum into the abdomen. All exposed parts are covered up with warm moist "sponges."

Intestinal adhesions must not be dealt with by forcible blunt separation, either with hand or sponge. First of all the supposed adhesion must be determined to be a real adhesion, and not due to the uplifting of the peritoneum by an intra-ligamentary invasion of the cyst. Then, in a good light (using the Trendelenburg position if necessary), the adhesion is put upon the stretch, and the intestine carefully snipped away from the tumour with sharp scissors, kept close to the tumour side of the adhesion (Fig. 266). Coils of intestine adherent in the sulci between cysts require very careful handling. It is always better to detach a piece of cyst-wall with the gut than to injure the latter by tearing or by denuding it of its outer coats.

Treatment of the Pedicle.—This may be secured by ligatures or by the compression cautery. The most recent and best form of the latter is the "electro-thermic angiotribe" of Dr. Downes of Philadelphia; but as the instrument and its accessories are troublesome and costly, and the result obtained is no safer than that obtained by the best method of ligature, this alone will be described.

The silk used for ligature of the pedicle is the best "Chinese twist," and should be comparatively fine, Nos. 3 and 4 being the sizes most generally useful. The silk is prepared by boiling in biniodide solution, of a strength approximately one per mille, in an enamelled steriliser before the operation is begun; the solution is made by adding one soloid of mercuric potassium iodide to one pint of water.

Some surgeons use catgut for ligature of the pedicle; but silk, as advised, is certainly better and safer. The finer sizes can be sterilised easily and satisfactorily by boiling in the mercury solution. Silk hardly swells at all in boiling, and holds firmly the grip which we make it take. Remaining quiescent in its bed, it becomes quietly encapsuled, and in the course of a few months is slowly absorbed. A blunt needle or forceps (Figs. 261 and 262) is commonly used to carry the ligature through the pedicle, so as to prevent the possibility of wounding any of the thin-walled vessels; but a sharp needle, if used intelligently, is quite safe. The ovarian vessels lie in the outer part of the pedicle near the infundibulo-pelvic ligament; the uterine lie in close apposition to the uterus, and some of the best surgeons are content to tie these separately, leaving the membranous interval free (Fig. 267). I generally use a sharp, widely curved needle of sufficient size to easily carry the No. 4 ligature silk, thread it with a long length of silk, and pass the needle through the broad ligament just under the ovarian vessels. One strand of the double silk is then cut, forming the ovarian ligature; the remaining strand is then pulled farther through the eye of the needle, and the needle passed back through the broad ligament near to, but not including, the uterine vessels. The needle is cut off, leaving two further ligature-loops—one for the uterine vessels, and one for the middle of the broad ligament. The ligatures are interlocked and the pedicle tied in a chain of three ligatures. The same method of ligature may be carried out, if desired, by the curved

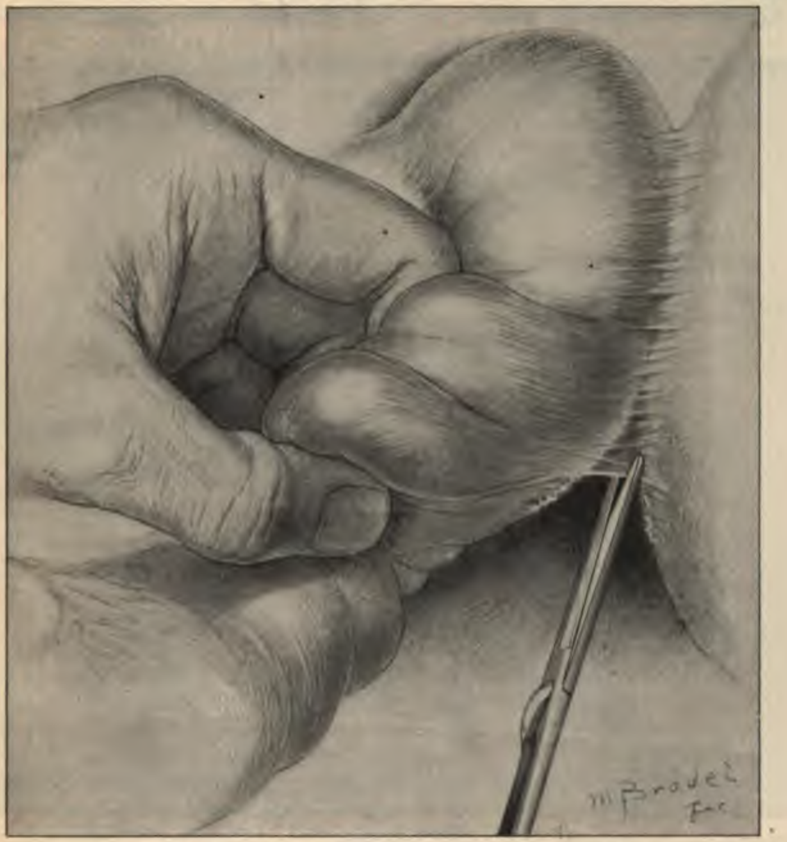


Fig. 266.

(From *Operative Gynæcology.* By kind permission of Professor Kelly.)

forceps (Fig. 262). With these a series of ligatures may be rapidly and easily placed in one long thread (Figs. 268, 269, and 270).

Two, three, or four loops are pulled through, as we desire to place three, four, or five ligatures; the loops are divided, and the ligatures then lie ready for tying. Before a ligature is tied, the ligature on each side should be looped in it. With a properly placed interlocking chain ligature, the largest pedicle may be compressed into small bulk, and every vessel safely controlled. It is hardly too much to say that if this method be used hæmorrhage from the pedicle need never occur. It was the "bunched" ligature, the tying of the pedicle in one or two portions only, whether by the Staffordshire knot or otherwise, that was responsible for the old accident of slipping of the ligature. The patient, when recovering from the anæsthesia, with every attack of nausea or sickness strained the large mass of tissue included in the ligature, and the resulting tension on the stump slowly pulled the tissues out from the ligature. When the broad ligament is tied in small sections and allowed

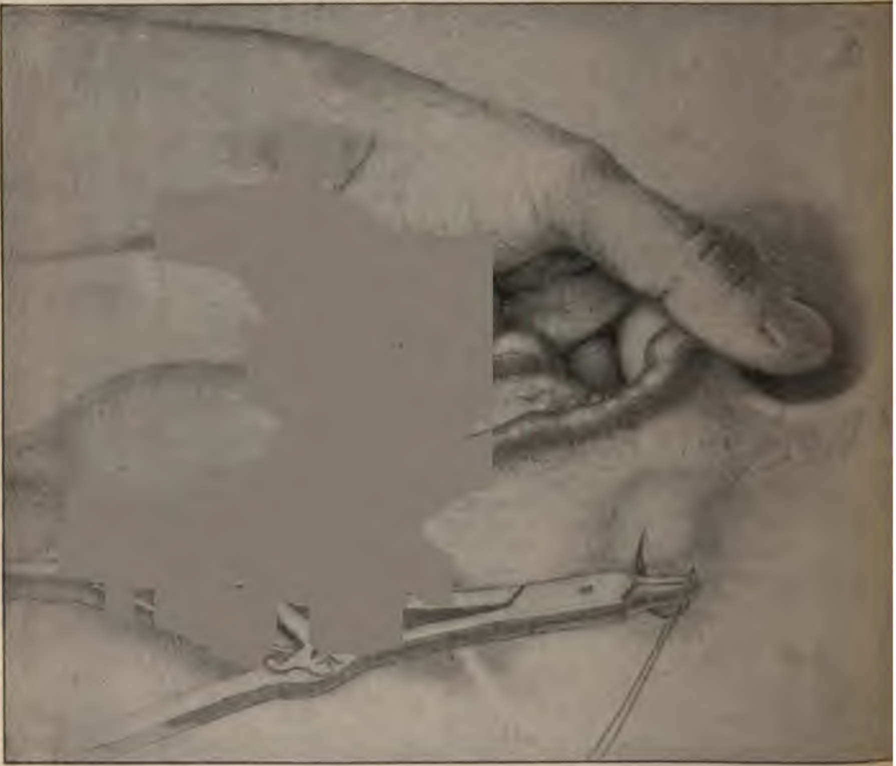


Fig. 267.
(From *Operative Gynæcology*. By kind permission of Professor Kelly.)

to hang loosely, tension is impossible, and the danger of hæmorrhage is reduced to the minimum.

While the ligatures are being tied there should be no traction on the pedicle, by the weight of the tumour or otherwise. In vascular or fleshy pedicles it is often good practice to hold the ends of the ligature, and to keep tightening it while the assistant cuts the tumour away; the same purpose is served by forcipressure. When the ligatures are tied, and the tumour is cut away, a final examination of the stump and ligatures is made, and if all be secure, the pedicle may be let slip into the cavity. If sponging or further manipulation is to be carried out, I usually place a medium-sized forceps on the tissues in the middle of the stump, and leave it there till the end of the operation, when a final glimpse makes certain that all is secure.

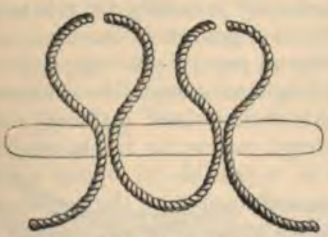


FIG. 268.—Triple interlocking ligature; threads inserted, loops divided.[1]

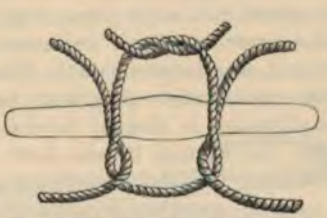
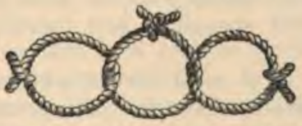


FIG. 269.—Triple interlocking ligature; threads interlocked ready for tying.



270.—Triple interlocking ligature; threads tied.

In placing the ligature there is no advantage in getting deeply inside the abdomen or close to the uterus. The ligature should be about half an inch away from the tumour, and division made by knife or scissors just free of tumour tissue. No doubt tumour tissue has often been left behind in the stump, yet it is significant that no case of recurrence of ovarian tumour on the side of removal has yet been recorded.

In cases of torsion of the pedicle, I place the ligature at the site of greatest twisting and do not undo the twist. The ligature is thus made to complete what nature has begun. In cases of large fleshy pedicles, a flap of peritoneum may be left to cover the raw surface, and so serve to minimise the risk of obstruction from intestine becoming adherent to it. It can easily be fixed over the stump by a continuous suture of fine silk.

When the pedicle is secured the other ovary should be examined. If there be any sign of disease, it should be removed also.

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[1] These illustrations are diagrammatic. The silk is drawn of excessive thickness, in order to show the method of interlocking the ligatures.

The Toilet of the Peritoneum.—If the isolation, delivery, and removal of the tumour be carried out with proper care, there should hardly ever be any soiling of the peritoneum sufficient to demand a special "toilet." Even in difficult cases where it is impossible to control the discharge perfectly, a careful isolation of the operation area from within the abdomen, by building a wall or floor of large aseptic "sponges" round the pedicle or operation region, will nearly always keep the intestines or other abdominal contents from dangerous contact. The more such sponges get soaked with blood and discharge, the better do they mould themselves as a close barrier, cutting off the rest of the abdomen from the operation-field. When they are removed at the close of the operation, the parts protected by them are often found perfectly clean though the sponge-pads themselves may be soaked with fluids.

In this way soiling of the peritoneum may generally be prevented. But sometimes, as in pre-operative rupture of a cyst, or in the removal of a malignant cyst with an excessively thin and papery covering, or in the removal of a large unstable hæmatocele (such as is found in connection with extra-uterine pregnancy or a tumour with twisted pedicle), either the abdomen is already flooded with foreign matter, or at the slightest touch the tumour breaks down and it is impossible to obtain a clean extraction. Under such circumstances a careful toilet of the peritoneum is of the greatest importance. This is to be obtained, first, by a sufficiently large incision for sight as well as for manipulation; secondly, by scooping out any large masses with the hand, palm upwards; thirdly, by careful and repeated sponging; and fourthly, by irrigation with sterilised hot water.

Irrigation.—This is of most service when there has been much escape of blood or blood-clot into the peritoneum; it is of less service when the foreign body is thick ovarian fluid; when pus is present it is, or may be, harmful. The pus from a large pyo-salpinx is usually sterile, and when the pus comes from this source irrigation may therefore be quite innocuous; but the pus from an abscess near adherent intestine or the vermiform appendix is likely to be virulent, and there should be no risk of washing this into inaccessible parts of the abdomen. Therefore, whenever pus is present and is likely to escape, it should be dealt with by sponge localisation as already described, rather than by irrigation and distribution.

Irrigation is best carried out from a large sterilised douche-can, filled with sterilised water at 100° F., and mounted on a stand or held by an assistant. To the tubing of this is attached one of the smaller ovariotomy trocar-tubes of Tait, and the water is allowed to run from this over the hand of the operator, so that he may assure himself as to the flow and temperature of the water. If this be satisfactory, the rubber tubing is pinched by the assistant and the trocar-tube passed by the operator through the incision into the pouch of Douglas at the lower part of the pelvis. The water is then allowed to run freely, and as it rises to the level of the incision it usually carries with it any clot or debris that may have escaped into the pelvis. In most cases this "pelvic irrigation" is all that is necessary; in a few, as in some cases of ruptured cyst, the washing-out of the peritoneal cavity needs to be abdominal as well as pelvic, alternate copious irrigation and sponging being necessary in order to get it even approximately clean. In all of these cases it is necessary to supplement washing-out by drainage. This will be considered later.

The Closure of the Abdominal Incision.—It is now generally admitted by all experienced operators that the simple through-and-through suture of the wound is insufficient. It is of prime importance for the prevention of a subsequent hernia that the aponeurosis should be united throughout the whole length of the wound. My own method of suture, which I have tested by many years' experience, is as follows:—

1. The peritoneum is first united with a continuous suture of the finest sterilised silk. 2. Interrupted sutures of silkworm-gut are passed at short intervals through skin, fascia, and muscle, without including the peritoneum. These are passed by the handled needle already recommended for this purpose (Fig. 265). 3. The aponeurosis is then united throughout the whole length of the wound with a close continuous suture of the same fine silk as that used for the peritoneum. 4. The interrupted sutures of silkworm-gut are tied.

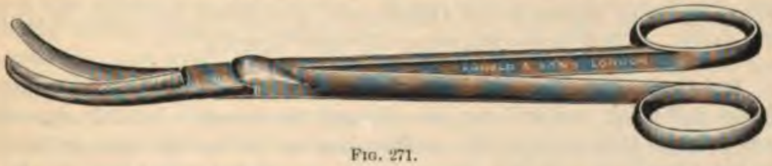

FIG. 271.

The immediate dressing of the wound should be of iodoform gauze, or one of the dry sterilised sponge-pads can be strapped over the incision. This first dressing should be small and confined to the neighbourhood of the incision, so that, without disturbing the first dressing, the nurse may afterwards readily ascertain whether there is any abdominal distension. Over this are placed several pads of sterilised wool and a plain bandage tightly applied.

Drainage.—This is very rarely necessary in present aseptic practice, but it is advisable when it is difficult to get the peritoneal cavity quite clean or when any pouch is left from which oozing may occur.

Drainage should be carried out by the pouch of Douglas. When the abdominal operation is fully completed, the patient is replaced in the lithotomy position, Auvard's speculum is inserted into the already sterilised vagina, and, after a further douching or swabbing with distilled water or biniodide solution, the posterior lip of the cervix is seized with a volsella and held upwards by the assistant. The operator, with scissors curved on the flat (Fig. 271), opens the peritoneum of the pouch of Douglas by one or two quick cuts behind the cervix (keeping rather closely to the back of the cervix, so as to avoid injuring the rectum) and follows up his incision by insertion of his finger. With this he recognises whether the peritoneum is opened or not, and if opened, enlarges the opening. Any blood or other discharge which has already collected is allowed to run out, and a thick double layer of sterile iodoform gauze is carried by the larger forceps or by a uterine sound well within the peritoneal cavity behind the uterus. The lower part of this gauze drain rests in the upper vagina, and when the volsella and speculum are removed should not be visible. It is advisable to have a sterilised silk ligature tied to the lower part of the gauze, so that it may easily be removed afterwards by sense of touch alone. This ligature-end should be placed, with the gauze, inside the vagina, and should not be visible externally. Such a drain may generally be left *in situ* for ten or twelve days with safety.

The posterior colpotomy and insertion of the drain may, exceptionally, be done before the closing of the abdominal wound, when there is likely to be some difficulty in finding the lower limit of the pouch of Douglas. In this case the abdominal wound is well covered by sterilised sponges, and a long forceps may be left in the pouch of Douglas to guide the operator from below.

VARIATIONS IN METHOD OF OPERATING ACCORDING TO THE NATURE AND POSITION OF THE TUMOUR

Dermoid Growths.—The contents of dermoid tumours are usually cheesy and thick, and will not run through the trocar. In such cases the best practice is to prolong the incision and to deliver the tumour bodily. As Mr. Christopher Martin has pointed out, most dermoid tumours have a well-marked capsule and are quite enucleable from the rest of the ovary. When the tumour is small, it may sometimes be removed without sacrificing the rest of the ovary or the corresponding Fallopian tube. Any raw surface left after enucleation or excision should be brought together with interrupted sutures of fine silk. However thoroughly hæmostasis be attended to, it is not safe to leave an ovary unsutured which has been split open. In one case, after this had been done by another surgeon, I had to open the abdomen for irregular obstruction, and found a coil of intestine everywhere adherent to the everted surfaces of the split ovary.

Papillomatous Growths.—These, from their nature and position, may occasionally present special difficulty in removal. They bleed freely on being handled, and are not only peculiarly liable to invade the subperitoneal tissues, but may to a very considerable extent erode or destroy the broad ligaments at the side of the uterus.

In such cases (as indeed in other instances of intra-ligamentary tumours) it is often advisable to carry out an operation very similar to supra-vaginal amputation of the uterus with removal of the ovaries and tubes. The ovarian vessels are secured first, then the uterine—at the cervix after separation of the bladder, if it is intended to remove the greater part of the uterus; and at the uterine cornu only, if the uterus be retained. In this way the circulation is controlled, and the growths may be enucleated and removed without danger of serious hæmorrhage.

Special care is needed in these cases lest the ureter of one side be injured. In one case in which I had the misfortune to wound a ureter which was lying in a mass of papillomatous growth, I had to remove the kidney in order to obtain a satisfactory recovery.

Solid Growths of the Ovary and Broad Ligament.—Solid growths of the ovary are usually fibromata. Those I have met with were not adherent, and only required a large incision for their removal. Solid growths of the broad ligament are usually myomata or fibromyomata, and are apt to occasion difficulty (as intra-ligamentary cysts may do) by the peritoneal displacement accompanying and consequent on their growth.

The most marked example of this that I have seen occurred in connection with a very large broad ligament fibroid of the left side, which grew until it distended the abdomen to an enormous size, and in its growth raised the sigmoid, the descending and the transverse colon. The transverse colon ran transversely across the back of the tumour, and the omentum formed a more or less adherent cap over the summit of the growth. The almost irresistible inference at first was that the transverse colon was adherent to the tumour. It was indeed closely attached to the tumour, but by peritoneal displacement and not by adhesion. Such displacements need study and prompt recognition, for while incision of the enveloping peritoneum above the displaced viscera may be immediately followed by an easy enucleation, leaving the bowel quite free and uninjured, any attempt at sponging off or cutting through "adhesions" must inevitably result in disaster.

Simple non-pedunculated cysts of the parovarian or broad ligament may generally be removed by enucleation without previous ligature of vessels. An incision is made through the peritoneal envelope, the cyst is tapped and the edges of the true cyst-wall seized at the opening with compression forceps. The cyst-wall is then enucleated from its bed, at first by blunt separation with the fingers and afterwards by this accompanied with traction on the half-extracted cyst.

Exceptionally a cyst of this kind may be enucleated from the vagina without opening the peritoneal cavity at all. A case of vaginal enucleation is reported in the *British Gynæcological Journal* for August 1904. It contained a pint and a half of fluid, reached half-way to the umbilicus, and was diagnosed as ligamentary before operation.

In all operations involving extensive enucleation it is necessary that raw surfaces should be covered in by suturing together the peritoneal free margins, otherwise the bowel may become adherent to them and obstruction ensue. Most of these cases too require drainage. This may generally be carried out by a gauze drain in the pouch of Douglas, as already described. In some cases, as in vaginal enucleation, the drainage is necessarily limited to the cavity below the peritoneum unless the latter has been opened inadvertently.

Ovariotomy during Pregnancy.—An ovarian cyst (not dermoid) complicating pregnancy is usually not adherent. It should be removed as soon as it can be certainly diagnosed; and in the middle months of pregnancy, if the operation be done with care and gentleness, it is the rule to obtain recovery without abortion. In most cases the usual operation may be easily carried out by pushing the gravid uterus to one side and engaging the ovarian cyst at the median incision. But sometimes the pregnant uterus rises well into the abdomen, leaving the ovarian cyst beneath it and blocking the pelvis. In this case—especially in the later months of pregnancy—the usual operation is very unsatisfactory. If attempted, eventration of the pregnant uterus may be necessary in order to reach and deal with the tumour below it. For this reason the alternative of vaginal ovariotomy is a valuable one and may be of signal service.

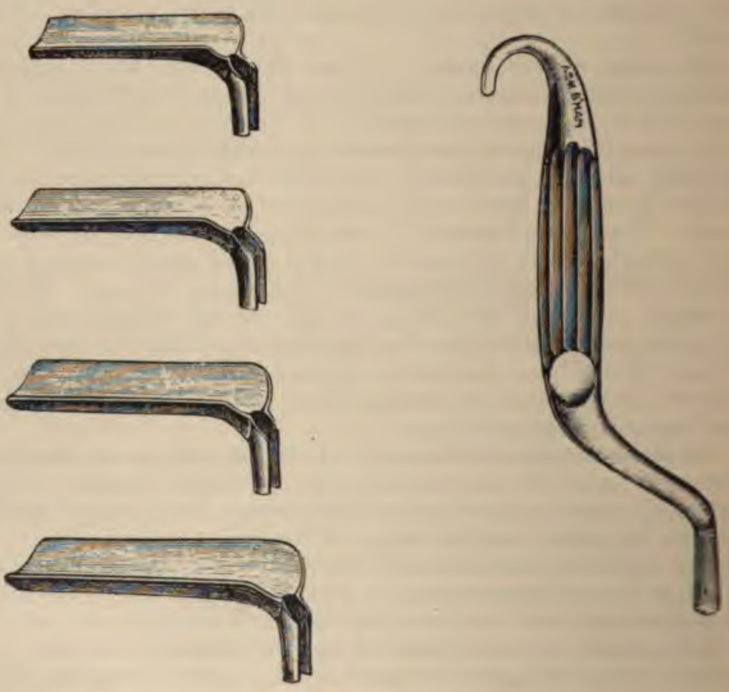

FIG. 272.

Vaginal ovariotomy may be performed for the removal of any small non adherent tumour of the ovary when it is desirable to avoid an abdominal wound. Even a large ovarian or parovarian cyst may be successfully removed by this method if there is reason to believe that the cyst is unilocular, non-adherent, and presenting at, or within, easy distance of the vaginal roof. If a mistake is made in minuter diagnosis no harm is done by the preliminary colpotomy, and the method of attack may be altered. It is quite exceptional, however, that such a change is necessary. In its initial steps vaginal ovariotomy differs but slightly from posterior colpotomy for drainage. The opening into the peritoneum behind the uterus is larger, so as to afford room for pelvic inspection and manipulation; but the vaginal disinfection and incision are otherwise identical. When the peritoneum has been opened and is found by digital touch to be free from adhesions, a Simon's speculum (Fig. 272) is used by the assistant to throw light directly into the pelvis. As a rule, the lower part of the cyst "presents" white, tense, and glistening, intestine being relatively pinkish and flaccid. When, both by touch and sight, the operator is sufficiently assured of the presence and position of the cyst, he taps it with a sharp trocar and canula—the old model of the "curved rectum trocar for tapping the bladder" being a very good one for this purpose (Fig. 273). As the fluid drains away, the collapsing walls of the cyst are seized with forceps (as in abdominal ovariotomy) and the cyst is gently withdrawn from the pelvis into the vagina.

The treatment of the pedicle in vaginal ovariotomy is sometimes a matter of difficulty. The extruded cyst fills up the vagina and prevents any satisfactory exposure of the pedicle. If so, it may be wise to clamp this with strong forceps and cut off the cyst before dealing with the pedicle. The pedicle is tied in two parts, after transfixion, with interlocked ligatures; or, if necessary, the forceps may be left on for forty-eight hours and then removed.

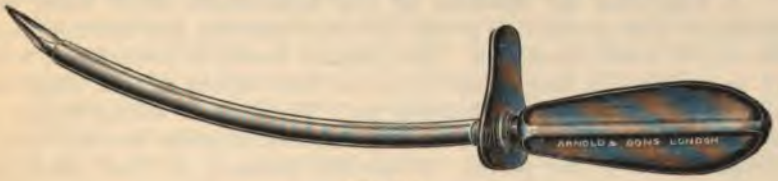

FIG. 273.

The "colpotomy" or vaginal incision, if large, may require a suture at each angle, and sometimes the posterior lip of the incision needs a continuous suture to check hæmorrhage from branches of the vaginal artery. The operation, when pregnancy is not a complication, is always finished by peritoneo-vaginal drainage; the uterus, which has probably been drawn down by traction on the pedicle, being fully replaced in normal anteflexion before removing the patient to her bed.

When pregnancy is coexisting, and it is hoped for the present to avoid abortion or immediate delivery, the peritoneo-vaginal wound may be quite closed by a continuous suture of fine silk, provided the pedicle be well ligatured. In this case too, if the uterus has been dragged upon, it should be gently replaced as far as possible at the conclusion of the operation. So far as I can judge from my own statistics, vaginal ovariotomy during pregnancy is quite as often followed by abortion as abdominal ovariotomy. The vaginal is only superior to the older method in the avoidance of any abdominal wound or scar, and in the comparative facility of attack when a complicating pregnancy is filling the abdomen above it.

OPERATIONS ON THE UTERINE APPENDAGES FOR CONDITIONS OTHER THAN OVARIAN TUMOURS

These may be thus classified :—

1. Operations for sterilisation, as in pelvic deformity, osteo-malacia, and myoma.

2. Operations for gonorrheal and tuberculous or rare forms of salpingitis.

3. Operations in appendix inflammation and abscess involving the right appendages and pelvis.

4. Operations in tubal pregnancy.

5. Operations in puerperal fever (particularly in thrombotic pyæmia).

6. Conservative operations on both ovaries and tubes (as in prolapse of ovaries, "chronic oophoritis," and chronic occlusion of the tubes).

1. **Operation for Removal of the Appendages when these are normal.**—This presents, as a rule, but little difficulty, and therefore calls for only a short description. The incision should be a small one, from 1½ to 2 inches in length, and its lower limit should be just above the margin of the supra-pubic hair-follicles. The first and second fingers of the left hand are now inserted into the abdominal cavity and are carried straight down to the pelvis. It may be necessary to push omentum upwards. The fingers, displacing intestines which are in the way, seek for the fundus uteri, and grasping the fundus between them, they are slipped along one or other broad ligament, gathering Fallopian tube and ovary in their grasp, and holding them there. These are now lifted out through the parietal wound, and arranged for application of the ligature. The parts to be removed are the ovary, with its mesovarium, and the Fallopian tube in its outer three-fourths, with its double fold of peritoneum or mesentery; in which also lie the parovarium and the vascular tissue known as the bulb of the ovary.

The ligature is placed by transfixion. The pedicle is tied in an interlocking chain of two or three sections. Even with an unaltered pedicle of normal broad ligament, it is safer to tie in three, deliberately ligaturing the vessels with but little tissue surrounding them. The silk, however, may be of No. 3 size, or even finer.

The operation, when essayed or practised for myoma, may occasionally present considerable difficulty, or may even be surgically impossible. In unsymmetrical tumours one ovary may be near to the surface and quite within reach, while the other lies deeply or out of reach.

Before removing the appendages on one side, we should ascertain if the appendages on both sides can be removed. It frequently happens that an ovary is much stretched, and so attenuated as to be almost undiscoverable; sometimes it is almost buried in the sulcus between two growths. In such cases the uterine appendages should *not* be removed, but the tumour itself should be removed by one of the methods of hysterectomy or by enucleation. Removal of the appendages as a treatment for myoma should now be limited to that special class of patients who suffer from myomata of small or very moderate size, not involving the broad ligaments, who are nearing the age of the climacteric "but are blanched by hæmorrhage, broken down in general health, unable to bear suspense or pain, and who demand the safest, easiest, and quickest operation that will give them permanent relief" (Taylor). In these cases the site of the incision may need to be somewhat higher in position, nearer and nearer to the umbilicus according to the position of the uterine fundus, so that the appendages may be readily accessible to the fingers. The whole operation should not take longer than fifteen or twenty minutes. If the conditions are found to be unsuitable, the operator should have permission and be prepared to go on at once with the graver operation of hysterectomy rather than subject the patient to a comparatively useless exploration only.

The toilet of the peritoneum and the closure of the incision are the same as described under ovariotomy for tumours.

No operations appear to be reliable or adequate in causing "change of life" or sterilisation of a woman that do not involve either (1) the complete removal of the ovaries or (2) the removal of the uterus.

Simple ligature of the tubes and double ligature of the tubes with or without the excision of a portion of the tube have been repeatedly tried as a means of preventing further pregnancy in cases of pelvic deformity, but without producing any certain result; that is to say, some of these patients have become pregnant afterwards. Even vaginal hysterectomy has, in one or two instances, been followed by tubal pregnancy; and the supposed complete removal of both ovaries and tubes (as in cases reported by Mr. Alban Doran and Mr. Meredith) may be (very exceptionally) followed by pregnancy. This may be accounted for by some ovarian tissue being left in the ovarian ligament on the proximal side of the ligature; for, as a matter of experience, we know that the full removal of the uterine appendages is all but invariably followed by sterility. It is important, however, to recognise the difficulty of obtaining with mathematical certainty absolute sterilisation in any given case, and especially by means of those milder operations on the tubes which have been advised and practised for this end, as accessories to Cæsarean section.

The only tubal operation which appears to be, and should be, capable of preventing conception is the wedge-shaped excision of both tubes from the angles of the uterine fundus, and suture of the uterine flaps over the mucous channel.

2. **Operation for Gonorrhœal Salpingitis.**—This may often be avoided, and wisely avoided, by the use of the mercury and iodine treatment as advised by the present writer (*British Gynæcological Journal*, August 1899). This treatment must, however, be thoroughly carried out

and maintained for some two or three years in order to produce a permanent result, and there are two classes of cases that, in spite of this, will continue to need operative treatment. These are the cases of acute pyosalpinx which urgently demand some immediate relief, and a residuum of the more intractable cases that, either because of the severity of the disease or refusal to submit to prolonged treatment, need a quicker and more certain cure by the surgical removal of the diseased organs. Some of these cases undoubtedly tax the surgeon's courage, skill, and patience to the utmost. Salpingo-oophorectomy for gonorrhœal salpingitis with dense adhesions may be one of the most difficult operations of surgery, and especially so when the gonorrhœal inflammation is complicated with multi-nodular myomata of the uterus or with tuberculous disease. In the one case the distortion and difficulty produced by inflammation and adhesion of the appendages will be aggravated by the uterine outgrowths and distortion; in the other, intestinal adhesions and possible ulceration of bowel may further complicate the operation with the danger, or actual occurrence, of intestinal perforation and fistula.

Three very different operations are in use for the treatment of inflamed and adherent appendages:—posterior colpotomy with opening up of abscess cavities and drainage; vaginal removal of the appendages with or without simultaneous hysterectomy; and abdominal enucleation and removal.

Posterior colpotomy with opening up of abscess-cavities and drainage is not only a most valuable means of treatment in all cases of acute pyosalpinx presenting in the posterior vaginal vault, but is not unfrequently the only true surgical method of dealing with the condition found. A certain number of these large abscesses on the left side discharge near their upper limit into the rectum. The bowel receives and carries away the overflow of pus only, the patient falls into a condition of hectic with a foul abscess, which is never emptied; and nothing but opening the abscess freely in its lowest part in the pouch of Douglas can save her life and cure her. To open the abdomen and to attempt to remove the abscess sac under such circumstances is not only unnecessary but highly dangerous. It is bad surgery.

The preparation and initial stages of the operation are the same as for vaginal ovariotomy. Very often the chief abscess-sac is opened by the scissors directly in cutting through the vaginal roof; sometimes before reaching the abscess a rather deep dissection has to be made through hard inflammatory tissue between the rectum and the uterus. In this case the point of the scissors is kept directed rather forward towards the uterus so as to avoid wounding the rectum, and every now and then with the forefinger of the right hand in the wound and the left hand on the abdomen above the pubes (a thin sterilised towel alone intervening), the operator makes a bimanual examination, locating the chief swelling or swellings, working with scissors or finger until these are fully explored. In this way two or three abscess-cavities may be opened and all the pus evacuated. If the surgeon be satisfied that the general cavity of the peritoneum is shut off by adhesions, the sac or sacs may be well washed out by an irrigator or douche. The operation is finished by gauze packing, each opened pouch receiving its pack, and the ends of the gauze employed being used for plugging the wound of the posterior colpotomy. Sometimes, when there are relatively very few adhesions, one or both appendages may be brought down and removed (if desired) by this incision, but a posterior colpotomy opening is not a suitable one for carrying out separation and detachment of very adherent organs. These need to be undone from below upwards, and the abdominal or anterior vaginal route is much better for this purpose.

When the cause is gonorrhœal, the operation of vaginal incision and drainage should always be followed by a prolonged course of mercury and iodide.

Vaginal Hysterectomy with Enucleation of Diseased Appendages.—The preliminary steps of the operation are as follows:—

(*a*) Complete liberation of the cervix from the vagina.

(*b*) Separation of the bladder.

(*c*) Opening of the pouch of Douglas and also of the vesico-uterine pouch.

(*d*) Ligature of the uterine arteries and division of the broad ligament on the uterine side of the ligatures.

(*e*) Delivery of the fundus uteri forwards by means of Museux forceps or volsella.

When this has been done the work of the extraction of the appendages begins. The easier side—or what appears to be the easier side—is chosen first. The tube is traced from its visible beginning, generally downwards and backwards; adhesions are undone by finger-separation and traction, the ovary and tube being often held with advantage by ring-forceps in the left hand while separation is carried out by the right forefinger. If both ovary and tube are securely held together, considerable traction may be used with but little danger of tearing; if either be held alone, the normal attachment will usually give way before the adhesion.

When the appendages have been fully liberated and brought outside, the broad ligament is tied and cut off on the distal side of the appendages and, the outside of the uterus being freed, the uterus is withdrawn outside the vulva. This gives much more room for the attack on the opposite side, and the removal of the appendages on this side should be comparatively easy. In gonorrhœal salpingitis, there is no urgent necessity to remove both ovaries if the uterus and tubes be fully removed. The latter are the foci of inflammation, and according to recent theory and practice it is better to leave one ovary or part of an ovary in the hope that the nervous disturbance on the cessation of menstruation will be less marked if some portion of the gland be retained by the patient. When the second tube, or second tube and ovary, have been set free, the broad ligament is tied and divided on this side also and the uterus with its adnexa is fully removed. The ligatures and stumps are examined for any insecurity or hæmorrhage; the ligatures are then cut short, and if, as often happens, there is some hæmorrhage from the posterior half of the vaginal incision, this may be controlled by sewing over its edges (from vagina to peritoneum) with a continuous suture of fine silk. The angles of the incision on each side will need chief attention. The opening in the vaginal roof is drained by a thick plug of iodoform gauze, and to keep it in position a second plug of gauze may be placed in the vagina below this.

Abdominal enucleation and removal of inflamed and adherent appendages is still the best operation when the case is a difficult one. The parts are much more under the control of the operator's fingers, and dangerous adhesions may be undone, if necessary, after light has been let into the pelvis and the organs are more or less exposed to view. For this reason the abdominal operation naturally divides itself into two classes: the first, in which the removal is carried out by touch alone; the second, in which sight is used as well as touch.

The first or older operation, popularised mainly by the example and teaching of Lawson Tait, can be performed through a small incision, and is applicable to the greater bulk of cases, but needs considerable operative training. The fingers, and the fingers alone, must distinguish between omentum, bowel, tube, ovary, and uterus; and the various degrees of size and resistance offered by a distended tube and the position in which the tube may be adherent, need study and a ready recognition.

The Fallopian tube may be found adherent upwards in the flank above Poupart's ligament; it may be found in front of the uterus in the vesicouterine pouch; it may be fixed to the opposite side of the pelvis: but the most common situation of an adherent tube, whether distended or not, is behind the uterus in the pouch of Douglas. This is, of course, its normal position, and the thin meso-salpinx folds over the back of the uterus with it, and covers or half covers the ovary. It is this "hooding" of the ovary by the meso-salpinx that specially needs recognition by the searching fingers. Sometimes when the tube is not distended, but quite adherent by its fimbriated end at the bottom of the pouch of Douglas, the hooding is complete, and the ovary can only be felt as a thickening under the double layers of peritoneum covering it. The first thing to do in such a case is to undo the fimbriated end of the tube deep down the pelvis. Greig-Smith's description of this operation is as follows: "The incision is made in the ordinary way, and may be about three inches in length. A little cloudy or pink serum often appears in the incision; not unfrequently there is a considerable amount of ascites. The first and second fingers of the left hand are carried to the fundus uteri, thence into Douglas's pouch and along both broad ligaments, and the state of affairs accurately made out. If there be any collections of fluid, purulent or sanguineous, it is wise at once to place a flat sponge in the pelvis to prevent contamination in case the cyst-wall is ruptured. It is often almost impossible to separate and deliver entirely an abscess with very thin walls: a sponge to surround the field of operation minimises the risks from rupture and diffusion.

The work of separation is now begun. Detachment is begun from below, the inflamed organs being unfolded upwards as the adhesions are separated. The firmest adhesions are usually to the posterior surface of the broad ligaments, and here bleeding is likely to be most free.

When the organs are detached they are pulled to the surface through the wound. Often they are quite sessile on the broad ligament, and some force may be necessary to bring them into sight. Such force is exerted, not by dragging on the organs themselves, but on their pedicle held between the two fingers. Liberation may be assisted by pushing down the broad ligament at its pelvic attachment; tearing or stretching its fibres, but not wounding its peritoneal envelopment.

Frequently the pedicle must be tied at some distance from the surface. By depressing the parietes and pulling the organs well up into the wound this may usually be done within sight, but sometimes the pedicle must be tied and divided entirely by touch."

Often, however, when the broad ligament itself seems to be contracted, the difficulty of bringing the appendages to the surface depends rather on some adhesion which has been overlooked or insufficiently attended to; and the operator should not place his ligature until he is satisfied that all restraining bands have been attended to and that the ligature he is placing will enable him to remove the whole of the disease on this side without undue tension on the pedicle.

The ligatures are placed by transfixion as already described, and the pedicle is tied by interlocking ligatures. The organs on the other side are detached and removed in the same way.

When, before operation, special difficulties are expected, or on opening the abdomen the condition cannot be made out with the fingers, or intestine is found to be adherent; then, before attempting any separation, it will be better to adopt the second method of operating in which sight is used as well as touch.

The patient is placed in the Trendelenburg position under deep anæsthesia. A larger abdominal incision is made than usual, reaching nearly to the umbilicus, and the omentum and intestines are coaxed upwards as far as possible out of the pelvis. Any omental or other adhesions preventing this are carefully undone or separated, and bleeding points ligatured. If necessary, the patient may be temporarily placed (for some four or five minutes) in an exaggerated position so as to favour the upward emptying of the pelvis, and large sponge-pads are arranged above and on each side of the uterus and appendages so as to isolate the operation-area from the rest of the abdomen. When this has been done, the head and chest of the patient may be raised a little without losing any of the advantage already gained.

The parts are now well inspected by direct light, and adhesions are undone by sponging or by small incisions, rather than by traction or tearing. Intestine, if needing detachment, must be liberated as already described by snipping across the stretched adhesion with scissors.

In this way the difficulties of almost every case of pure gonorrhœal inflammation may be slowly and wisely overcome. There are, however, some tuberculous cases in which coil after coil of intestine may be so closely bound together as absolutely to forbid any attempt at separation. These are probably the cases of "congenital abscess of the peritoneum" noticed by some of the older writers. If any sort of channel can be made or found to the appendages, these, if more affected than the other abdominal organs, may sometimes be removed; or the surgeon may content himself with opening and removing any collections of pus or caseous matter, and instituting iodoform gauze drainage by the vagina, as in posterior colpotomy.

In all cases where extensive separation of organs has been carried out there will be considerable hæmorrhage and some danger of perforation. Hæmorrhagic oozing that cannot be stopped by ligature should be treated by vaginal drainage.

If there has been any danger of injury to the bladder, it should be emptied by the catheter before the abdomen is closed, and every piece of intestine that has been adherent should be carefully examined, and any weak spot fortified by an in-folding suture.

3. **Operation in Appendix Disease involving the right Ovary and Tube.**—In this case the incision should be right-sided or vaginal. The right ovary and tube can always be reached and comfortably examined or removed from an "appendix incision," but it is often impossible or very awkward to deal with an adherent appendix from the central incision.

In a number of cases in women a foul appendix-abscess is found in the pouch of Douglas, while in the abdomen above the only evidence is that of hard thickening and tenderness. This needs recognition both by the general surgeon and the gynæcologist. The free opening of the pouch of Douglas giving vent to the pus at the most dependent part leads to immediate relief, if not complete recovery, and this without the slightest danger; the search for the abscess from above will often lead to a general fouling of the peritoneum and a rapidly fatal issue. Even in children and young virgins, if circumstances call for it, the examination by, and use of, this route must never be neglected.

4. **Operation in Extra-uterine Pregnancy.**—Tubal hæmatocele in the pouch of Douglas, due to tubal pregnancy, is best treated by posterior colpotomy, removal of bloodclot, washing out, and gauze drainage. A broad ligament pregnancy may sometimes be opened from the vagina or above the groin of the affected side without opening the peritoneal cavity, and then, if at all advanced, may be treated by removal of the fœtus, leaving the placenta to come away later with the discharge and drainage. All other cases of extra-uterine pregnancy are better treated by abdominal section in the middle line, with removal of both fœtus and placenta. This is generally found attached to the Fallopian tube or its remains,

and the recognition of it forms the best guide to operative treatment. It is usually necessary to remove the tube, or tube and ovary, on the side affected.

One special class of operation urgently called for in many cases of early extra-uterine pregnancy is the operation for profuse internal hæmorrhage when the patient is in immediate danger of death. In such cases the sooner the abdomen can be opened aseptically the better: it is no good waiting for any hypothetical improvement before operating. The nearest available room is rapidly turned into an operating room, the general arrangement being as in Fig. 250. If the emergency be at night a number of candles and lamps may be placed beyond the foot of the operating table (in the position of the window in the diagram) in order to afford sufficient illumination.

Unless he has thoroughly skilled assistance, the surgeon arranges everything he may need within reach, so that he may act as his own assistant; he thoroughly cleans the patient's abdomen himself, and uses clean boiled towels, or clean towels wrung out of boiling water, as covering and barriers around the operation field. He sterilises his hands and arms and puts on sterilised clothing, or, if nothing better be available, uses as an operating coat a large clean towel (boiled) pinned behind his neck. He opens the abdomen by a fairly free incision. A stream of fluid blood usually pours out of this, if the diagnosis has been a correct one; and the surgeon immediately feels for the source of the bleeding on one side or other of the uterus. As soon as this is found all further hæmorrhage is stopped by ligature and removal of the ruptured tube or tube and ovary. The blood and blood-clot is washed out as far as possible by free and copious hot-water irrigation (as described under this heading), and the operation is preferably completed by vaginal drainage. If there be no time or convenience for this, the abdomen may be closed entirely, provided the surgeon can be satisfied as to the complete asepticity of his work. If there should be some doubt about any detail, it may be permissible in this operation to use a glass drainage tube in the lower part of the incision, reaching nearly to the bottom of the pouch of Douglas; but if drainage is necessary, vaginal drainage is very much better.

At the close of such an operation, when the wrist-pulse is imperceptible, it may be necessary to place the patient for several hours with the legs raised high above the head and bandaged in order to keep the circulation going until the danger of death is over.

5. **Operation in Puerperal Fever (Thrombotic Pyæmia).**—It is not generally recognised that in the thrombotic form of puerperal fever the thrombosed vessel or vessels may usually be felt on a careful bimanual examination, and that in the more chronic cases very much can be done by operation to check or alter the progress of the disease even when repeated rigors are taking place. At the uterine side of the thrombus small abscesses form, either in the substance of the uterus or in the broad ligament, and the liberation of the pus contained in these, with gauze

packing of the broad ligament or of the pouch of Douglas behind the thrombosed vessel, has proved of signal service in treatment.

The operation is carried out very much as in a direct posterior colpotomy, but the incision is extended toward the side chiefly affected. The side of the uterus and the broad ligament are searched both by sight and touch for these foci of suppuration; sometimes their yellowish colour can be seen through the uterine wall. Whenever found these are freely incised, and the cavities (if large enough) are packed with iodoform gauze. Finally, when no more pus can be found, and especially when an ovarian vein appears to be chiefly affected, the pouch of Douglas is well opened, and a thick cushion of iodoform gauze is passed under the thrombosed vessel and allowed to remain *in situ* for ten or twelve days.

6. **Conservative Operations on the Appendages.**—The enucleation of a dermoid from the ovary has been already described. The excision of a follicular cyst or of diseased follicles or of a specially sclerosed or hardened part of an ovary may be carried out by a V-shaped incision, the opposing raw surfaces being brought together afterwards by sutures of fine sterilised silk. Such operations, when some definite tumour can be removed, are very successful, but the opportunities for their performance are rarely met with. The great number of cases in which conservative operations seem to be specially called for are cases of chronic adhesions of the appendages in young patients; and the greater bulk of these cases (due to chronic gonorrhœa) are quite unsuitable for conservative surgery.[1]

Before any question of conservative surgery is considered, it is of the utmost importance to settle the diagnosis; and if the probable cause be gonorrhœal, it is, as a rule, better to do nothing operative or to fully remove the appendages of both sides. Even when the operation is preceded and followed by mercurial and iodide treatment, the greatest caution is needed, and it is wise to carry out any conservative treatment by means of posterior colpotomy (as already described), or to finish any operative measures with vaginal-drainage, leaving the liberated appendages resting on a soft drain of iodoform gauze.

When gonorrhœa can be absolutely excluded, the inflammation having been solely outside (and not within) the Fallopian tubes, much more latitude may be given in the choice of operation. Salpingostomy is always permissible when an otherwise healthy tube is simply closed by peritoneal adhesions, provided the cause of the inflammation has been satisfactorily attended to (as by removal of the appendix in chronic appendicitis), or has worn itself out as in adhesions after septic peritonitis. The tube is well opened, and the divided mucous membrane sewn to the serous covering by a few stitches of the finest sterilised silk, so as to maintain a patent opening in the tube. Such an operation may sometimes be followed by pregnancy, but, generally speaking, the interference is futile.

Conservative operations have often been undertaken for retroversion with prolapse of one or both ovaries, attended by ovarian tenderness, pain, and dyspareunia, the uterus being fixed forwards and the ovarian ligament or ligaments shortened. My experience of such operations is not a favourable one. If there is no radical disease of the ovary calling for removal, the better treatment is by through curettage of the uterus and extra-peritoneal shortening of the round ligaments.

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[1] The treatment of acute gonorrhœal pyosalpinx by posterior colpotomy has been described on p. 878.

ACCIDENTS AND COMPLICATIONS

Secondary Hæmorrhage—Slipping of the Ligature.—This is probably always preventible. If the pedicle be tied, as directed, by a chain of at least three interlocked ligatures, very little tissue being included in each ligature, it is almost impossible for bleeding to take place later. If the pedicle has been tied *en bloc* either by Staffordshire knot or otherwise, and especially if the two broad ligaments, one on each side of the uterus, be held by such ligatures, every act of retching or vomiting will tend to pull the stumps out of the encircling ligatures, and serious arterial bleeding may take place a few hours after the operation is over.

This is denoted by rapid rising of the pulse-rate, increasing pallor, sighing respiration, and deadly faintness. On reopening the abdomen for such a condition, it is important to remember that the wound left after removal of the ovary and tube is a three-branched one (Fig. 274). All parts need to be collected by catch-forceps in order to re-apply satisfactory ligatures. The special conduct of the case (apart from this) is the same as that for profuse internal bleeding due to early tubal pregnancy.

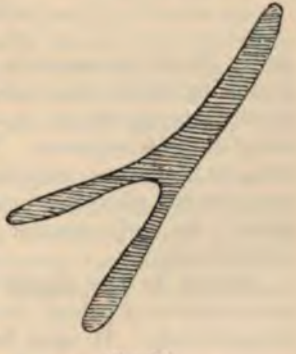

FIG. 274.

Injuries to the Hollow Viscera.—These are sometimes unavoidable, but are less common than formerly, the use of the Trendelenburg position facilitating accurate workmanship and careful dissection.

Intestine, if wounded, should be sutured at once, first by a uniting suture of fine silk, and then by one or two layers of covering suture of the same material.

A special injury peculiarly apt to occur in extracting tuberculous, malignant, or very adherent tumours from the left side of the pelvis, is a laceration or even complete rupture of the rectum. This is a difficult injury to repair. A method carried out with considerable success by Mr. Rutherford Morison, is worthy of special notice. The steps of the operation are thus described by him (*British Gyn. Journal*, 1901):—

1. The diseased bowel is excised. 2. A glass bobbin, with india-rubber tube affixed, is tied tightly into the upper end of the sigmoid flexure. 3. The rubber tube is passed down from above through the lower cut end into the rectum, where it is aided to pass through the

anus by the finger of an assistant. 4. The tube is drawn upon till the ligature on the upper cut end of the bowel is inside of the lower cut end of the bowel. 5. A ligature is then passed round immediately below the lower cut end and lightly tied. This makes the junction water-tight. 6. The tube is again pulled upon, while the lower portion of bowel immediately below the button is steadied, until a short intussusception is produced. This is maintained by "Lembert" sutures.

In some cases of injury to the rectum, with or without resection, a valuable accessory to treatment consists in artificial separation of the pelvis from the cavity of the abdomen. By suturing together the infundibulo-pelvic ligaments and the rectum to the uterus, the pelvic cavity may be cut off entirely from the abdominal cavity. The secondary cavity of the pelvis can then be plugged with iodoform gauze and drained from the vagina, so that any secondary leakage, although temporarily distressing, need be no bar to final success.

Injury to the ureter is apt to occur during the removal of broad ligament tumours, during ovariotomy for eroding papillomatous tumours of the ovary, and during abdominal hysterectomy for myomatous outgrowths and for cancer. In each of these conditions the danger of injury should be specially present to the mind of the operator, prevention being better than cure. When cut across or opened the accident is usually recognised at once, the tubular character of the injured duct being directly apparent. The divided ureter must be re-united at the time, or if (as has unfortunately happened) a portion of the ureter has been cut out with the tumour and the divided ends cannot be approximated, the only possible treatment is to remove the kidney of the affected side.

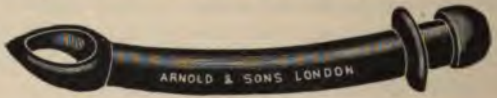

FIG. 275.

Injury to the bladder is, of all accidents, next to the leaving a sponge-pad or a pair of forceps in the abdomen, the most likely to occur unconsciously. It may, however, always be detected or suspected on passing the catheter, by finding the urine tinged or deeply coloured with blood; and in the progress of any operation involving the separation of adhesions in the neighbourhood of the bladder it is well before closing the abdomen to test the condition of the bladder. An injury to the ureter may, of course, similarly affect the urine, but this is more easily recognised at the time than an injury to the bladder.

When a bladder injury is discovered, it is, as a rule, easily repaired by a continuous fine suture, protected by one or two layers of covering suture; but any leakage of urine previous to repair will make a careful cleaning of the pelvis and abdomen, followed by hot-water irrigation and vaginal drainage, very advisable before the operation is considered to be complete. It is also advisable for the patient to use a Skene's catheter (Fig. 275) for the first week or longer. This is changed every night and morning.

Foreign Bodies.—Sponges, forceps, or needles have occasionally been left within the abdomen, and have caused prolonged disease or even death. The necessity for care on this point has been already insisted upon, and some recent actions in the law courts have still further emphasised the need of constant watchfulness, routine, regularity, and systematic counting in all abdominal operations.

Intestinal obstruction, following ovariotomy or similar operations, arises in most cases from adhesion of the bowel to the stump of the divided pedicle. For this reason some surgeons cover in the raw surface by a super-imposed peritoneal suture. The method of suturing the pedicle advised in this article is, however, much less likely to be followed by dangerous adhesion than the older method of ligature *en bloc*.

Very rarely a loop of intestine may be caught or compressed by a vaginal drain, or unfortunate adhesions may occur between intestine and some raw surface exposed by intra-ligamentary enucleation.

The differential diagnosis of true obstruction after operation from the pseudo-obstruction caused by peritonitis is often difficult. In both cases there is usually persistent vomiting, abdominal distension, and insuperable constipation. The knowledge of the operation performed and the method of its performance will materially assist the surgeon in coming to a right judgment. The condition of the pulse, too, is of some service. When general peritonitis is increasing, the pulse usually rises rapidly in frequency. This is, indeed, the worst sign after abdominal operation. When the insuperable constipation is due rather to obstruction or local peritonitis, the pulse may remain slow until the bowel gives way and general peritonitis is superadded.

The treatment depends altogether on the diagnosis. In true obstruction the sooner the abdomen is re-opened and the intestine set free the better for the patient; in general peritonitis, if severe, there may be some chance for the patient in simple, good nursing (as described under after-treatment), but death will be directly induced by unwise interference.

AFTER-TREATMENT

While the operation is in progress three or four hot-water bottles should be wrapped in a small blanket and placed inside the bed. When the patient is replaced in bed the bed-clothes are turned down; the hot-water bottles are taken out of the blanket, the blanket is wrapped round the patient, and the bottles are replaced beside her.

One morphia suppository of ¼ to ½ grain may be inserted within the rectum at the close of the operation.

At first the negative duties of nursing are of most importance. Warmth, quiet, and subdued light having been ensured for the patient, beyond the counting of the pulse every half-hour for the first six hours, and, subsequently, the four-hourly record of pulse, temperature, and respiration, nothing is to be done, and nothing given to the patient but sympathy and encouragement as required. The holding of the head in sickness, arrangement of the pillows, and, in simple cases, the turning of the patient occasionally to one side, are perhaps all the duties required.

Nothing in the whole range of surgery is more remarkable than the ease and rapidity with which a patient recovers after an ordinary ovariotomy. If we let the patient alone and do not worry her with fussy regulations and injudicious applications of tentative therapeutics, she will probably feel perfectly well on the third or fourth day. She may lie in any position she likes, on back or side; she may pass water when she desires, and need not do so before; and within wide limits she may drink what she likes, provided it is warm and absorbable by the stomach. To keep the patient in the supine posture, to draw the water at stated intervals, and to starve the patient of all liquids, is quite unnecessary in the majority of cases, and causes suffering in not a few. Comfort is a therapeutic measure of real importance, and we should do everything possible to promote it. We should look with suspicion on any adjuvant to surgical healing which causes discomfort or suffering to the patient.

One of the most common complaints after ovariotomy is backache. The causes of it are various. Sometimes it is a symptom of peritonitis, and when associated with abdominal distension, frequent bilious vomiting, and inaction of the bowels, it is a symptom of grave importance. More commonly it may be due to the strain of keeping straight on a hard mattress a back which is naturally curved; it is certain that to turn the patient first on one side and then the other affords most relief. A hot rubber cushion or water-bottle under the sacrum often relieves the aching. Changing the patient from one bed to another with clean, fresh linen and well-shaken mattress is a luxury which is highly appreciated.

Thirst in this as in most abdominal operations is nearly always present, and for a time, while there is any retching or vomiting, it is better to withhold liquids by the mouth. But great comfort is afforded by washing out the mouth with hot water, and if the thirst be severe, a pint of hot water administered slowly by the rectum will relieve it.

In the more serious cases, as in those with severe hæmorrhage, nutrient enemata may be given from the beginning, brandy ℥ss. and beef tea to ℥iv. and brandy ℥ss. and milk to ℥iv. alternately every six hours. If these are well retained, the amount of nutriment, and especially of milk, may be considerably increased, until the patient is able to retain half a pint at each injection.

Sometimes, as when vaginal drainage is employed, it is necessary, or at all events safer, to pass the catheter about every six or eight hours for four or five days. With the use of the catheter comes the first danger of nursing. A dirty catheter may cause foul cystitis and kill the patient. If the surgeon be in any doubt about the training or cleanliness of the nurse, it is better not to order the catheter at all, unless obliged to do so. But in this case he must be very careful that any gauze dressing or ligatures are retained in the upper third of the vagina, and cannot be soiled by voluntary micturition. A close watch, too, must be kept on the amount of urine passed and on any indications of suprapubic distension or pain, due to a slowly distending bladder.

After twenty hours (or earlier), if there should be continued vomiting, increasing abdominal pain, or any distension, a simple enema is given of soap and hot water. If this be successful and the patient passes flatus and motion, some water gruel is permitted by the mouth, and this, alternately with milk, may be given through the day (one tablespoonful every two hours) so long as the bowels continue to act. The enemata are repeated every four or five hours until the motion returned is abundant; after this they are continued two or three times daily.

If the bowels refuse to act and the patient has a rising pulse, with or without green vomiting and distension, turpentine enemata are given (turpentine ℥ss., castor oil ℥j., soap and water to Oj), and these are repeated as often as every three or four hours. In addition, calomel (2-5 grains) is given in powder or tabloids, and all nourishment is withheld until the bowels begin to act.

In a rather serious case the second night and third morning is the critical time. During the night enemata may be required every three hours, and there is considerable opportunity for a good nurse to show her skill and ingenuity in their administration. They are usually given most easily with the patient on her back. Occasionally this should be varied, and the enema should be given while the patient is lying on her side.

After the enema is given gentle massage of the abdomen may assist the passage of flatus. Midway between every two enemata a rectal (or vaginal tube), well oiled, may be passed within the sphincter ani and allowed to remain there for a time. Motion and flatus will sometimes be passed in this way when no immediate result is obtained by the enema. About this time (the second evening and night) there is decided danger of neglecting the time for action when distension is increasing and the pulse is rising. Prompt and persevering effort will often save the patient's life; five hours of inaction may sometimes lead to a fatal issue. A good nurse under these conditions does not wait for orders, but gives repeated enemata on her own responsibility, and asks the surgeon as soon as possible whether this is to be supplemented by any or further administration of calomel.

The administration of calomel when there is any peritonitis is a matter demanding thought and carefulness. From one-tenth to 5 grains is the usual single dose after operation, and from 10 to 12 grains is the usual maximum quantity that can be given altogether. When the symptoms are acute—vomiting, distension, and inaction of the bowels—it is better to give five grains at once, and to follow this up by lesser amounts of two grains or one grain until the maximum is reached. When the symptoms are much less marked and there is only perhaps a very little delay or difficulty in obtaining a good evacuation, $\frac{1}{10}$ to $\frac{1}{2}$ grain in tabloid form, given every hour, is often a better form of administration.

When the bowels act freely from the beginning, a little tea with toast may be given on the second afternoon, milk pudding (if liked) may be allowed on the third day, fish on the fourth, chicken on the fifth. Cases less rapid in their progress towards convalescence may require to be one or even two days behind in this dietetic course.

The foregoing directions apply to all ordinary cases of ovariotomy and allied operations in which the intestinal tract has suffered no injury.

In any case involving suture or excision of intestine a different line of practice is required. The patient is fed entirely by nutrient enemata, gradually increasing the quantity injected as the bowel is able to retain it. These enemata are given at first six-hourly and afterwards four-hourly if all the enemata are retained. Once in every twenty-four hours the rectum is washed out with a larger enema of soapy water, but no purgatives are given, nor is any purgative added to the enema. This treatment is kept up for four or five days (or longer), until there is every reason to believe that the sutured intestine is sufficiently united.

The safety or danger of allowing food by the mouth in these cases must be estimated by the operator, with his knowledge of the needs of the individual case; when the union is obviously as perfect as surgery can make it, much greater latitude is permissible in this respect than one in which there may be some doubt as to the security from leakage.

After abdominal section, when the stitches are removed (on the ninth or tenth day if silkworm gut has been used for suture), the wound should be well supported by long strips of good adhesive strapping fixed across the incision from loin to loin. These should be renewed daily or oftener until the incision is soundly healed throughout.

After vaginal section the patient may usually sit up in bed on the thirteenth or fourteenth day, and be allowed to get out of bed on the following day. In abdominal section the time of getting up must be largely governed by the healing of the wound. It is rare that a patient is fit for removal under three weeks from the date of operation.

A belt is always advisable after abdominal section with large incision. No mechanical support is necessary after vaginal section. In abdominal section, when there has been a small abdominal incision and separate suture of the peritoneum and aponeurosis, a belt may often be dispensed with.

The following brief particulars put down at my request by Miss Richmond, the head of the nursing staff at the Hospital for Women, Sparkhill, Birmingham, may give additional information on points usually neglected in a purely surgical treatise.

"*Bedstead.*—Iron, spring mattress, 6 ft. 6 in. by 3 ft., 2 ft. high.

Mattress.—All hair.

Mackintosh.—1 yard square, pure rubber, which can be boiled, is very durable and does not irritate.

Draw-sheet.—Double, 1 yard wide, to cover mackintosh exactly, to reach from knees to under pillow, long enough to tuck in each side.

Purgative Enemas.—These are given with a Higginson's syringe or douche-can and tube. Two pints of soapy water about 100° F., with turpentine (℥ss.-℥j.), if ordered, are injected slowly, without air, the patient lying on her left side. If retained or evacuated without result, a flatus tube of pure rubber (firm, but flexible and easily cleaned) may be vaselined and passed into the bowel as high as possible, gentle massage being applied at the same time to the upper part of the abdomen and left side over the transverse and descending colon. A pint of hot water with one ounce of magnesium sulphate will often prove effectual when turpentine fails. Should several enemas be retained, an injection of glycerine (℥ss.) may be successful in producing an evacuation.

Nutrient Enemas.—We use milk ℥v., white of one egg, hot water ℥j., and brandy ℥ss. (omitting the white of egg from each alternate enema). Nutrient enemas are given by a funnel and tube.

Vomiting.—The persistent vomiting of anæsthesia may often be stopped by giving the patient ʒss. of sodium bicarbonate in half a pint of warm water. Immediately after this has been vomited a piece of thin, dry, crisp toast is given with some hot milk."

Complications of the Nursing Period.—The more important disturbances or complications during the nursing period are (first) those produced by direct germ-infection. These vary in kind or degree from acute fatal peritonitis, tetanus, or septic pneumonia, to stitch-abscess. The varieties of infection and manifestation are very numerous, and it would be impossible within the limits of this article to enter into any detail regarding them. They are all preventible, the channels of infection being mainly through dirty hands and nails, dirty operation-area, dirty sponges, and dirty silk. The channel of infection in some cases of tetanus appears to have been through badly prepared and imperfectly sterilised catgut.

Other difficulties or troubles of the nursing period less avoidable are:—Enema rash or nettle rash, hæmatoma of the broad ligament, parotitis and mania.

Enema rash or nettle rash occurs under two forms. In the one it is a genuine urticaria with raised wheals of reddened and elevated skin; in the other it appears as a rash closely resembling that of scarlatina. Either may be followed by some desquamation. It appears to be due to the absorption of toxins by the bowel after the free administration of enemata; in some cases the rash may be due to turpentine-absorption. It is often quite sufficient to raise the temperature one degree or more (Fahrenheit). It is always accompanied by severe itching, and usually lasts for three or four days. The itching is best relieved by the following "dusting powder":—

Zinc oxide
Amyli . . . . . . āā℥j.
Camphoræ . . . . . ʒss.
Sp. vin. rect. q.s.
Ft. Pulv.

Hæmatoma of the Broad Ligament (the Lost Disease). — Some years ago one of the most common sequels of ovariotomy was hæmatoma of the broad ligament. This was apt to occur suddenly, after about nine or ten days, and often about the time of the first menstrual period following the operation. It was accompanied by rather severe but transient pyrexia, the temperature rising to 102° or 103° F. On examination a large lump could easily be felt on one side of the uterus, rather fixing it and pushing it to the opposite side.

The hæmatoma usually ended in resolution; occasionally, or rarely, it suppurated and had to be opened and drained. So common was this complication of hæmatoma that I remember the time when four or five patients lying almost side by side were all suffering from the same affection. Now, I have not seen a case for some years.

Many surgeons, finding that its disappearance appeared to be synchronous with the use of the blunt pedicle needle (Fig. 261), have supposed that the puncture produced by the passing of the sharp needle (always used in the earlier ovariotomies) must have been responsible in some way for the occurrence of the hæmatoma. I do not think so. I have been using a pointed needle for the passing of the chain ligature during recent years, and there has been no return of the hæmatoma. The cause is more likely to have been due to a septic ligature which opened the vessels by an ulcerative process.

THE LATE RESULTS OF OVARIOTOMY AND OF REMOVAL OF THE UTERINE APPENDAGES

Hernia of the Cicatrix.—This, which used to be a common result of imperfect healing of the abdominal wound, may be generally prevented by the independent suture of the aponeurosis (see p. 871). When the hernia is reducible, complete comfort can be usually obtained by the use of an abdominal truss. This is much better than a belt for the support of a hernia. When irreducible, operation is advisable, adhesions being undone, the different layers of the abdominal wall dissected free, and the parts re-united. The worst hernias are those which follow removal of ovaries or uterus by the old clamp operation. Some of these it is almost impossible to cure; a hernia of the cicatrix may be a greater infliction than the original disease for which the operation was undertaken.

Intestinal Adhesions.—Recent adhesions as a cause of acute obstruction have already been considered. Chronic adhesions, especially when light and admitting of some movement, may cause acute abdominal pain, indigestion, and, sometimes, when the adhesions have lengthened sufficiently, the form of obstruction known as obstruction by bands.

The pain due to such adhesions is generally referred to the same side as that of the original removal, but it is a fresh pain, altogether different (as a rule) from that existing before operation, and it is more or less associated with digestion. When there is any real obstruction, the small intestine is usually involved, and persistent and serious vomiting supervenes.

A second operation is always called for in these cases, and a very large amount of success attends the interference.

Sexual and General Results.—After ovariotomy (*i.e.* the removal of one ovary or an ovary and tube as for ovarian tumour), there is, or should be, no injury to the general or sexual health if the other ovary and tube be healthy. The patient may have a happy married life, bear children, and these of different sexes, as in a life without operation. It seems necessary to re-state this, as the old theory of one ovary for each sex has lately been revived.

When both of the appendages are removed the case is different. The probability of pregnancy is practically lost, though exceptional cases have been reported apparently contradictory to this. Menstruation ceases, the uterus atrophies, the "change of life" is established, and the chain of nervous symptoms generally associated with this may, or may not, be distinguishing features of the post-operative period. In a very limited number of cases (about 1 per cent), the atrophic change extends to the vulva and vagina, and vascular degeneration, or a form of "Kraurosis vulvæ," affects the vaginal entrance and becomes a bar to intercourse. Even without any of these results, as after the removal of only one ovary, an ailing woman who has been something of a burden to her husband, may find that operation is made the excuse for neglect or unfaithfulness. This is important to remember as bearing on the question of operation in cases of pelvic gonorrhœa.

Climacteric disturbances are not necessarily any worse when produced by operation than when occurring as the result of normal changes; but they are caused in the one case by the surgeon, and in the other by a natural law. Much more consideration and criticism therefore is directed to them in the one case than in the other. In both, occasional instances are found of very distressing symptoms or sequels, such as character-alteration, melancholia, and suicide. These have been attributed during recent years directly to the loss of the ovaries, but without perhaps quite sufficient evidence; for the ovaries are not lost at the natural menopause, and similar symptoms are occasionally met with after vaginal hysterectomy when the ovaries have been left behind.

It is, however, well established now that the ovaries have, during all the period of sexual activity, some decided influence on the general organism, apart from the production of ova. They influence metabolism in some way, so that a much larger proportion of phosphates is excreted by the urine when the ovaries are present than when they are absent. This excretion of phosphates during sexual life is sometimes excessive, and causes harm to the individual, as in osteomalacia, and in a few allied conditions where the patient suffers from brain weakness and neuritis, due apparently to this hyper-secretion. These patients are benefited or cured by the removal of the ovaries. In addition to this, it must not be forgotten that there are a very considerable number of women who are greatly improved in health by the change of life occurring at the natural menopause.

On the other hand, many patients suffer by the premature loss of ovarian tissue, and the ovaries should not therefore be sacrificed needlessly or without reason. As a general rule, when the ovaries have been removed "neurasthenic women seem to suffer the most, and the nearer the patient is to her natural menopause the less the severity of the symptoms" (Kelly).

After the observation of a large number of patients who have passed through the artificial menopause, I am more and more convinced that in the great majority of those who are workers, if the operation has been rightly undertaken for genuine disease, the disturbances caused by it are passing, and the final result is good. Many, whom I know personally, have done the very best work of their lives since the operation was performed which rescued them from a living death. The unsuccessful cases are to be found mainly among the rich, the idle, and the alcoholic.

In concluding this article I wish to add that although it has been almost entirely re-written, I have constantly had before me the original essay of Mr. Greig-Smith, whom I had the privilege of knowing, and for whose genius and work I have a warm admiration; that I have endeavoured to maintain the same spirit and arrangement which marked his own writing, and have frequently used the same words and phrases when there was no reason for alteration. This re-statement of our position as regards ovariotomy may therefore be taken, I hope, as one in which modern methods and modern knowledge have been fully considered without wilfully discarding any of that "older wine" of teaching and practice laid down for us in the last generation by those who were indeed the *makers of abdominal surgery*.

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J. W. T.

ABDOMINAL HYSTERECTOMY

The term "hysterectomy" should be confined to the operation of removal of the uterus, but it is also used to indicate the operation of removal of the body of the uterus only, to which the term "amputation of the uterus" is more applicable. Although "hysterectomy" literally means the removal of the uterus by operation, it is also applied to operations in which, in addition to the uterus, the appendages, ligaments, or even pelvic peritoneum and glands are removed. It would be better if "hysterectomy" were limited to the complete removal of the uterus with or without its appendages, and "supra-vaginal amputation of the body" were applied to the operations in which part or the whole of the cervix is left behind. This would be in conformity with the term "supra-vaginal amputation of the cervix."

In order to get rid of the confusion which thus arises, it is at the present time the custom to apply the term "total abdominal hysterectomy," or "panhysterectomy," to the removal of the whole uterus, and "supra-vaginal hysterectomy," or "sub-total hysterectomy," to the operation in which only the body with perhaps part of the cervix is removed.

The indications for hysterectomy may be divided into four classes:—

1. Conditions in which the uterus may be removed although it is neither enlarged nor diseased. In this class may be placed the removal of the prolapsed, inverted, perforated, or ruptured uterus. It is sometimes advisable also to remove the uterus because of its intimate connection with, or adhesion to, other tumours (ovarian, tubal, etc.); sometimes, too, when, after the separation of an adherent tumour, an extensive raw or bleeding surface has been left. The healthy uterus is also sometimes removed after Cæsarean section. These conditions rarely justify the removal of the organ.

2. The presence of non-malignant growths in the uterus (chiefly fibromyoma) forms the commonest indication for hysterectomy. Not every

case of fibromyoma requires an operation; in many cases the tumour causes no symptoms, and a patient with a fibroid uterus which causes no symptoms is better off than a patient after hysterectomy, however skilfully performed. The conditions which render operation advisable or necessary are the presence of a large tumour in a young woman, rapid growth of the tumour, hæmorrhage giving rise to anæmia, pressure on the urinary or intestinal tract, and degeneration or infection of the tumour. A tumour growing in the cervix usually requires prompt removal, and sometimes, though very rarely, it is necessary to remove a fibroid uterus during pregnancy.

3. Malignant growths (carcinoma, sarcoma, chorionepithelioma) afford the next commonest indication for hysterectomy. In all cases of malignant disease of the body in which the growth is confined to the uterus the organ should be removed as soon as possible. In cases where the disease is limited to the cervix, either the cervix or the whole uterus may be removed, most operators preferring the removal of the entire organ. In addition to the uterus, the tubes and ovaries and part of the vagina may be taken away, and it has lately been recommended to remove the pelvic peritoneum, the lymphatic glands, and, in advanced cases, even portions of the bladder and ureters. The results of these extensive operations will be given later. There appears in any case to be good reason for the removal of the tubes and ovaries in addition to the uterus (although the difficulties of technique are thereby somewhat increased), for it is found that secondary growths in the appendages are by no means rare.

Some gynæcologists do not operate if the uterus is fixed, and, speaking generally, fixation, being due to the extension of growth into the surrounding tissues, is a contra-indication; but occasionally fixation is due to inflammatory exudation, and I have known a patient, condemned to speedy death as inoperable under such conditions, remain well six years after hysterectomy.

4. Microbic infection of the uterus may sometimes be an indication for the removal of the organ.

These four classes of cases will require corresponding modifications in the operation. Thus a small uterus, especially if infected, may be most safely removed through the vagina. A large fibro-myomatous uterus will require an abdominal operation. A malignant organ will require special precaution (preliminary removal of the cervix by galvano-cautery in cases of malignant disease of cervix, closure of the cervix in malignant disease of the body), in order to prevent local implantation of cancer cells —*Impfmetastase*. An infected organ also will require that special care be taken to prevent infection of the peritoneum or cut surfaces by closing the cervix with suture or ligature; or the danger of such infection may be lessened by removing the uterus when possible through the vagina.

Fibromyoma and malignant disease form the chief indications for the removal of the uterus. The operation in other cases only differs in being simpler. I shall therefore confine my remarks chiefly to hysterectomy for these two diseases.

Varieties of Hysterectomy.—The uterus may be removed by the abdominal route—*abdominal hysterectomy*, or by the vaginal route—*vaginal hysterectomy*, or by a combined method—*abdomino-vaginal*, if the operation is commenced by the abdomen and finished by the vagina, *vagino-abdominal* if it is begun by the vagina and terminated by the abdomen.

The uterus may also be removed by the sacral route after cutting away part of the sacrum—the *Kraske or sacral operation*, or through the perinæum—*perinæal* method; but these two last operations are now rarely performed, and in the case of uterine affections offer no advantages.

ABDOMINAL HYSTERECTOMY

A. **For fibromyoma.**—Abdominal hysterectomy for fibromyoma may be performed in one of three ways.

1. By amputating the uterus at some level above the vagina and treating the stump extra-peritoneally.

2. By amputating the uterus at some level above the vagina and treating the stump intra-peritoneally; this is the "sub-total hysterectomy" of French authors, the "supra-vaginal hysterectomy" with "intra-peritoneal (sub-peritoneal or retro-peritoneal) treatment of the stump" of English authors. The term "retro-peritoneal treatment of the stump" is limited by foreign writers to Chrobak's method of so treating it; hence arises considerable confusion.

3. By removal of the whole organ—total abdominal hysterectomy, pan-hysterectomy. It is to this operation that the term hysterectomy should be limited.

1. *Supra-vaginal amputation of the uterus* ("Supra-vaginal hysterectomy") with extra-peritoneal treatment of the stump.

This operation, having been superseded by the other kinds of hysterectomy, is now rarely performed. It is still the best operation, however, for the removal of the uterus in advanced cases of cancer complicating pregnancy, and might perhaps be employed with advantage in certain cases where the uterus contains an infected fibroid or when the operation is done for hæmorrhage during labour. It was until ten years ago the safest operation for fibroids, and cannot therefore be omitted here.

In addition to the ordinary instruments, either Koeberle's serre-nœud or an elastic ligature is required, also long pins to pass through the uterus to prevent the wire or elastic ligature from slipping. The operation should, of course, be performed aseptically. Sterilised iodoform gauze should be provided to wrap round the stump in addition to the plain sterilised gauze to cover the rest of the wound. A table permitting the use of the Trendelenburg position should be used.

The patient is prepared for operation by the administration of aperients and enemata, the skin is prepared in the usual way, and the catheter is passed immediately before the operation. If the tumour is large or grows into the pelvis or broad ligament, it is well to pass a sound before the operation to determine the limits of the bladder.

The abdominal incision is made slightly to one side of the middle line through the inner border of the rectus muscle. The peritoneum being opened, the hand is passed into the cavity to explore the tumour. If no adhesions are found, the uterus, in a simple case, is pulled out of the abdomen either by means of the hand or a large volsella. (A corkscrew is often recommended, but should not be used, as it may open some infected cavity in the tumour.) Then the uterus may be surrounded by the wire of the écraseur, placed so as to lie above the bladder and inside either one or both ovaries, drawn up and finally screwed very tight by means of the screw of the écraseur. A pin is now thrust through the lower segment from side to side, just above the wire a protecting cap fitted on to the point of the pin, and the tumour cut away about an inch above the wire. The stump is then further trimmed by cutting out a conical piece from the centre so as to leave the stump as small as possible.

The abdominal wound is then sewn up by means of silkworm gut sutures, passing through all the layers of the abdominal wall, just taking in the edge of the peritoneum, the suture above and the suture below the stump catching up the peritoneum on the surface of the stump below the wire. Before the silkworm gut sutures are tied the anterior sheath of the rectus is sutured by interrupted buried silk sutures. Horse-hair sutures are applied to the skin. The wound is dressed with sterilised gauze, and the groove between the stump and the skin is packed carefully with iodoform gauze, which also covers the surface of the stump. The iodoform gauze should be renewed daily. The écraseur should be interfered with as little as possible, but if oozing occurs it should be tightened. The deep stitches are removed on the eighth day, the superficial ones on the fifteenth day. The stump generally sloughs and comes away at the end of about three weeks, and the cavity left granulates up in about eight weeks, leaving a weak spot in the abdominal wall which is very liable to become the site of a hernia. It is not always that the wire can be applied as described; but when possible it is advisable to avoid the use of ligatures to the broad ligaments, which may easily become infected; for this reason too I think it is a mistake to stitch the peritoneum all round the stump to the parietal peritoneum.

Of course in some cases it is necessary to tie and sever the round ligaments and the broad ligaments, to peel down the bladder and to enucleate portions of tumour before a proper pedicle can be made; but, when possible, it is better to avoid the use of ligatures in this operation. Instead of the écraseur some gynæcologists use an elastic cord wound round the cervix above the pin; it is thicker and less powerful than the écraseur, but may be used if the special instrument is not at hand.

2. *Supra-vaginal amputation of the uterus* ("supra-vaginal hysterectomy," "sub-total hysterectomy") with intra-peritoneal (sub-peritoneal, retro-peritoneal) treatment of the stump.

The incision is made over the inner edge of the rectus muscle, the anterior sheath opened, the muscle cut through at one spot, and its fibres separated with the handle of the knife for the length of the incision. The peritoneum having been opened, the tumour is seized with the hand or a volsella and drawn forwards, adhesions being separated if present. If the tumour cannot be drawn up through the wound it may be necessary to tie both round ligaments and cut them between two ligatures. These are best passed by means of a short thick needle, doubly threaded, which is passed first under one then under the other ligament; the needle is then cut off, and the two ligatures divided in the middle so as to give two ligatures for each ligament. The division of the round ligaments may be sufficient to free the uterus, but if not it may be necessary to enucleate tumours from the broad ligament. In doing this the incision through the capsule of the tumours should be made through a non-vascular part, or, if there are many vessels, they should be tied by passing a needle under them. Bisection of the tumour will facilitate the enucleation; but it is rarely necessary to resort to this; and as the tumour may contain infective material it is better to avoid it.

The fibroid uterus having been withdrawn from the abdomen, sterilised gauze soaked in warm sterile salt solution is laid over the intestines and the patient placed in the Trendelenburg position, if necessary. Both for covering intestines and for sponges I use nothing but long rolls (twelve yards long) of sterilised gauze, the end of which is left hanging out of the wound. The centre of the gauze roll is clipped to one of the sterilised towels covering the patient, and unrolled by pulling on the free end as required. Under no circumstances must the gauze roll be cut. I believe this arrangement gives the greatest safeguard against leaving a piece of gauze in the abdomen.

If the round ligaments have not been tied this is now done, and an incision is carried from the two cuts in the ligament across the anterior surface of the uterus well above the bladder. This flap is then pushed down carefully with the handle of a scalpel or with gauze. The broad ligaments are then tied inside the ovaries and cut between the ligatures. If one ovary is diseased the ligament may be tied outside that ovary. One ovary, at least, should be preserved if possible. Mere enlargement of the ovary is often due to œdema in these cases, which sometimes subsides even during the course of the operation. By pressing down the cut broad ligament the uterine artery can be felt on each side, and be tied by passing a needle under it, or it may be seized with forceps and tied later. The uterus is then amputated at about the level of the internal os. It is safer, as pointed out by Dr. Gow, to pass another ligature through the stump from before backwards, so as to include in its loop the outer portion of the stump and the uterine artery which has already been tied separately. If the cut surface of the stump is very vascular, I have usually either passed a buried suture under and around the vessels by means of a Hagedorn needle, or have checked general oozing by turning the cut edges in towards each other by sutures so as to press the oozing surfaces together. The peritoneal flaps are then stitched over by a fine continuous suture, the peritoneum is washed with a few pints of warm salt solution, some of which is left in the abdomen; the wound is then closed.

The chief drawbacks to this operation are:—

(1) The danger of injuring the bladder or the ureter.

(2) The risk of hæmorrhage, either at the time of the operation or later.

(3) The risk of infection of the cervix or its sutures; of adhesion of intestine to the stump; or of sloughing of the tissues.

(4) The risk of malignant disease subsequently developing in the cervix.

Injury to the bladder may generally be avoided by opening the abdomen well above its limit, enlarging the wound downwards, and taking great care in peeling down the bladder to press towards the uterus rather than towards the bladder. In cases where there has been cellulitis between the cervix and bladder, and where the bladder is thin, there is always considerable risk. The ureter is best avoided by keeping close to the cervix, by tying the uterine artery separately, and by exercising great care in enucleating tumours which may displace the ureter; in some cases it is well to bisect the tumours, though this should be avoided if possible.

The danger of hæmorrhage is chiefly met with in cases where the vessels are much enlarged. Serious hæmorrhage at the time of the operation may be prevented by rapid operating, the use of forceps, and careful isolated ligature of the vessels; but slight oozing will sometimes occur after the most careful treatment of the vessels and stump, and the blood collecting under the peritoneal covering may easily become infected and give rise to inflammation, purulent discharge, or even fatal peritonitis.

If too many ligatures are applied to the cervix the vitality of the tissues may become lowered so as to favour infection, or lead to actual sloughing; if too few ligatures are applied oozing of blood may occur, which will also favour infection.

Various modifications of the operation have been devised to make it more rapid, and to prevent immediate or remote hæmorrhage and its consequences. The most rapid method of performing the operation is that of Faure (1), which he calls "decollation of the uterus." In this operation the supra-vaginal cervix is cut through with scissors from behind forwards; the bladder and ureter are separated and pushed forwards by the fingers, the two broad ligaments clamped and cut, and the uterus removed.

Kelly's (2) method (Fig. 276) is also a rapid and good method. He ties and cuts the ligament on one (the easier) side down to the internal os, then divides the cervix, seizes the uterine artery on the other side before division, then divides the ligament from below upwards.

In order to check hæmorrhage Schroeder stitches up the raw surfaces of the cervical stump in layers with buried sutures.

Zweifel passes several interlocking sutures through the whole of the cervix from before backwards; Chrobak passes iodoform gauze through the cervix into the vagina in order to get drainage, and stitches the peritoneum over it. Harrison Cripps (3) stated (in 1896) his intention in future to use a glass drainage-tube extending from the lower angle of the wound to the bottom of Douglas's pouch. Whether he has carried out his intention I am not aware, but the use of an abdominal drainage-tube has many disadvantages, amongst them being the frequent occurrence of hernia in the scar.

In order to lessen the risk of oozing and of infection it has been suggested that the stump should be stitched to the abdominal wall (v. Harber, Wölfler), or even turned into the vagina (Meinert and others). These modifications of the operation are unimportant, and have merely a historical interest.

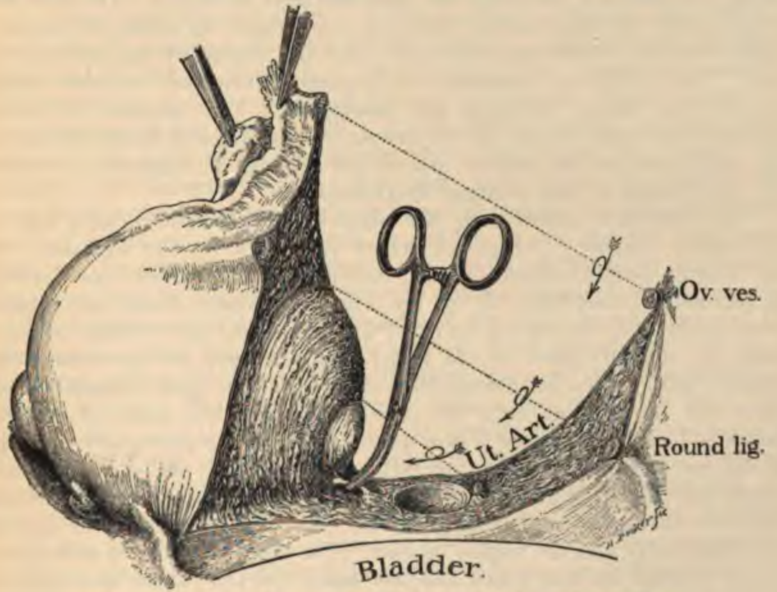

FIG. 276.—Abdominal hysterectomy. (From Kelly's *Operative Gynæcology*.)

3. *Total Abdominal Hysterectomy* (*Panhysterectomy*).—The operation of the removal of the whole uterus is destined to replace the supra-vaginal amputation, as the intra-peritoneal treatment of the stump replaced the extra-peritoneal.

The operation may be commenced as in the last described operation, but carried further until the vagina is opened. This may be done on one side first from above downwards, and on the other side from below upwards, as in Kelly's operation, and may be performed by means of mass-ligatures, or by means of forceps, with subsequent isolated ligature of the vessels.

But all operations from above down are far inferior to the operation from below upwards devised by Doyen (4). Its success depends upon a careful attention to details, and as every operator modifies the operation in some respects, I will give here the technique which I have employed in 41 cases.

The patient is prepared for operation in the usual way, and especially for two days before and on the day of operation the vagina is douched with 1 per cent solution of formalin followed by 1 in 3000 solution of perchloride of mercury. The Trendelenburg position is used. The operation is performed "aseptically." Sterilised long gauze rolls (12 yards) are used for covering the intestines and sponging. The rolls are fixed to the sterilised towels covering the patient by means of Spencer-Wells' forceps, which clip the towel and the centre of one end of the roll. The rolls are unwound as required, warm salt solution being poured over those covering the intestines. The incision is made through the inner border of the rectus, the peritoneum being opened in the upper part of the incision first if the bladder is displaced or drawn up; the wound is then enlarged downwards.

The uterus is seized with the hand or volsella and drawn out at the wound and over the pubes, where it is held by the assistant. If the uterus is held down by the round ligaments, these are divided as previously described; if by the broad ligaments, these are clipped temporarily near the uterus by two pairs of forceps, and divided between them; if tumours grow in the broad ligament they are enucleated, the incision being made in non-vascular tissues, and in such a position that there will be no tension in the peritoneum when the final purse-string suture is tied. The uterus is now drawn well over the pubes, and the edge of the cervix is felt between the right middle finger placed in Douglas's pouch and the left finger placed in front over the bladder. A longitudinal one-inch incision is then made upon the edge of the cervix in the middle line posteriorly and the vagina opened. The right forefinger is then introduced through the hole which has been made into the vagina, and feels the external os. The posterior lip, or if possible both lips, are seized with a single-toothed volsella and drawn through the opening. Mucus is wiped away from the cervix, and the single-toothed volsella is replaced by a powerful four-toothed instrument which gives a firm hold of the cervix and closes the uterine canal. Before this is tightened the single-toothed volsella is withdrawn. The cervix is then drawn strongly upwards by the volsella held in the operator's left hand, the lateral attachments of the cervix to the vagina are snipped through, then the anterior fornix is opened. The cervix can now be drawn up, the cellular and vascular attachments become stretched and are divided by the scissors or scalpel, the cutting edge being kept *close to the uterus.* If the uterine arteries are seen they are first clipped and then divided, but generally they are divided and the spurting vessel clipped. The cervix is now drawn strongly upwards and away from the bladder, which is easily separated by the finger covered with a bit of the gauze roll; the anterior pouch of peritoneum is then opened. The uterus is now only attached by the upper parts of the broad ligaments; the right broad ligament is gently compressed with the fingers of an assistant and rapidly cut through from below upwards, the tube being divided at its inner end, unless it is diseased, in which case it is entirely removed. The operator then draws the uterus over to the left and divides the left broad ligament from below upwards, the whole of the tubes and ovaries being left behind. The ovarian arteries and any spurting branches are seized with catch forceps; and the lower parts of the broad ligaments are carefully examined for any spurting vessels, which are clipped. Then all the bleeding vessels are carefully under-stitched with very fine silk, and the ends of the ligatures cut short. If there is any extensive raw surface it is closed by running a fine silk suture round it. Both ovaries are left if possible. If one is diseased it is cut away, its vessels are carefully under-stitched, and the edges of the cut peritoneum drawn together by a continuous suture of fine silk. A purse-string suture is now applied to close the peritoneum completely, the vagina being left open. The suture is of moderately strong floss silk; it is passed by seizing with long forceps the left edge of the incision in Douglas's pouch, and taking up first a fold of the peritoneum to the left of the incision then below, then to the right of the incision; next a fold of the right utero-sacral ligaments close to its cut end, then the ovarian ligament, the upper edge of the Fallopian tube near its cut end and the right round ligament, the peritoneum above the bladder (in two or three places), the left round ligament, and so in the reverse direction down to the commencement of the suture. The suture is drawn tight after the parts have been dried with gauze, and all free edges of peritoneum have been tucked in towards the raw surface. The suture is then tied and the ends cut short. They are not seen, and the peritoneum is quite smooth, but puckered towards the centre where the knot is. The pelvis is flushed with hot salt solution, the patient is placed in the horizontal position, about a pint of hot salt solution being left in the peritoneum; the abdomen is closed by through-stitches of silkworm gut, interrupted buried fascial stitches of fine silk, and horse-hair stitches for the skin. The sterilised gauze dressing is held in place by a many-tail flannel bandage. The silkworm gut sutures are removed on the eighth day, the skin sutures on the fifteenth day. The patient may get up at the end of three weeks, never sooner.

Some operators have practised the vagino-abdominal and the abdomino-vaginal methods of removing the uterus, but these offer no advantage over Doyen's operation in the case of fibroids.

On the relative value of Supra-vaginal Amputation and Total Hysterectomy in the case of Fibroids.—The old operation with extra-peritoneal treatment of the stump was a fairly safe operation. Thomas Keith (5) operated in 38 cases with 3 deaths = 7·8 per cent; Meredith (6) in 53 operations had 6 deaths = 11·3 per cent. I, out of 14 operations, lost one (from acute mania). Two of my cases thought to be large fibroids proved afterwards to be sarcomata, so that I lost 1 case of 12 fibroid uteri operated on = 8·3 per cent.

In 1895 Hauck (7) gave the following table obtained from the literature of the preceding five years :—

	German operators.	Foreign operators.
Extra-peritoneal treatment	(308 cases) 8·17	(258 cases) 8·53
Intra ,, ,,	(307 cases) 9·44	(343 cases) 9·63

From this table it will be seen that even as late as 1895 extra-peritoneal treatment of the stump was safer than the intra-peritoneal. The reasons which have led to its abandonment in the case of fibroids are the prolonged convalescence and the great liability to hernia in the scar.

At the present time there is much difference of opinion amongst gynæcologists as to the relative value of supra-vaginal amputation with intra-peritoneal treatment of the pedicle and total abdominal hysterectomy. With regard to the mortality it is very difficult to get reliable statistics. The latest table given by Winter (8) for supra-vaginal hysterectomy shows 689 cases with 32 deaths = 4·6 per cent. In this table, however, Henricius is credited with 105 cases with 2 deaths, but on investigation I find that Henricius's figures only apply to the operations done by Chrobak's method. Praeger disputes them, saying that Henricius had 43 supra-vaginal hysterectomies with 8 deaths—a very different thing! Again, Olshausen is credited with a 6 per cent mortality (for the years 1892-1897), whereas in his early cases (1878 to 1891) he lost 19 patients out of 67 operated on = 28·4 per cent. Zweifel is stated to have had 2 deaths in 132 operations (1892-1899), whereas Olshausen gives Zweifel's results as 122 cases with 5 deaths. Hofmeier had 118 cases with 5 deaths; von Rosthorn 122 with 4 deaths; Wyder 77 with 6 deaths, and Winter 167 with 9 deaths. From these figures and from general considerations, I conclude that in the hands of certain skilled operators the immediate mortality of the supra-vaginal amputation with intra-peritoneal treatment of the stump is nowadays something under 5 per cent.

With regard to total abdominal hysterectomy, the best results have been obtained by Roussel (9), who lost only 2 of 104 cases operated on (74 being removed by the abdomen with 2 deaths, and 30 by the vagina without a death). I have removed 43 fibroid uteri by total abdominal hysterectomy with one death (from embolism). Chrobak (11) operated on 20 cases, and Sneguiref (12) on 23 cases without a death, and Martin (10) on 90 cases with 6 deaths. I believe the mortality in total abdominal hysterectomy depends largely upon details of technique; Roussel's, Sneguiref's, and my own (except the first two) were operated on by Doyen's method, which I consider the best. They give together 138 cases with 3 deaths (of which 2 were from embolism).

Without making too much of these figures, I think we may conclude that the mortality of the total operation by Doyen's method is not greater in experienced hands than that of the supra-vaginal amputation. In comparing the two, it must also be borne in mind that many of the most dangerous cases (large cervical fibroids) are of necessity removed by total hysterectomy even by the advocates of the partial operation.

The total hysterectomy performed as above described is superior to the supra-vaginal amputation in many respects. It provides for drainage, gives security against unrecognised hæmorrhage, does away with the cervix, which may become infected, slough, or contain unrecognised malignant disease, or develop malignant disease later on. It is also less likely than the supra-vaginal amputation to give rise to adhesions. The operation takes about a quarter of an hour longer than amputation; but this is the only important point in which it is inferior; its superiority in other respects has prevented me from resorting to amputation for fibroids during the past five years.

A great many cases have now been published of cancer or sarcoma developing in the cervix sometime after the supra-vaginal amputation. Hinterstoisser (13) met with it once in 32 amputations. Richelot (15) has met with 4 cases; Le Dentu (16) has seen 2; Hartman (17) 1; Matthew Mann (18) has met with 3 cases; Péan (19) met with it "several times." Condamin (20) has published 2 cases, and Baldwin (21) has also seen 2 cases; Rochard (22) has met with it once. Other cases have been published by Jacobs (23), 2; Wehmer (25) and Menge (27), sarcoma; Savor (28), 4 cases; Erlach (29), 1; H. Freund (30), 1; Briggs (31), sarcoma, and Bland-Sutton (32). The last-mentioned author, however, still practises amputation, but afterwards cuts a core out of the cervix; the advantage of this practice is not apparent. Bazy and Beurnier (35) state that they have seen cancer develop in the vaginal vault after *total* hysterectomy. It is to be hoped that their important observations will be published in detail, but they cannot be used as an argument against those who advocate the removal of the cervix, because, amongst other reasons, of the risk of the development of cancer in it.

B. Abdominal hysterectomy for malignant disease.—For malignant disease of the uterus (either of the body or cervix) there is an increasing tendency to operate by the abdomen. The reason for operating by the abdomen in malignant disease of the body is that the cervix can be closed per vaginam, and the organ can then be removed by the abdomen in one piece, the chances of infection and of local implantation of the growth being thereby diminished. It appears to me that the abdominal operation should be done in all cases where the uterus is large or the vagina narrow.

1. *Abdominal Hysterectomy for Malignant Disease of the Body.*—It is best to commence by an abdominal incision which allows exploration of the abdomen for secondary growths. If none is found, the uterus should be lightly curetted, irrigated, and packed with gauze; the cervix should be closed by tying a strong ligature passed through the cervix encircling the cervical canal; further, the external os should be stitched up, and the cervix separated from the vagina with the galvano-cautery by a circular incision, and the bladder pushed up as in

vaginal hysterectomy. Then Douglas's pouch may be opened either from below or from above, and the uterus with the tubes and ovaries intact may be removed by the abdomen from below up, as in Doyen's operation for fibroids; but I think it is in many cases preferable to remove the uterus from above down by clamping and afterwards tying the broad ligaments or their vessels, the uterus being manipulated as little as possible, in order to avoid the escape of fluid from the cervix, or even tearing of the organ. After removal of the uterus and its appendages the peritoneum should be closed by a continuous silk ligature, the vagina being left open.

In cancer of the body the vagino-abdominal method of performing the operation is preferable to the purely abdominal method. The abdomino-vaginal method should not be performed except perhaps after Cæsarean section for cancer, as recommended by Olshausen.

The operation enters into competition with vaginal hysterectomy. It is no doubt slightly more dangerous than the vaginal operation, which yields very good immediate and remote results. It has the advantage that it permits easier and freer removal of the broad ligaments and appendages, and gives greater control of the blood-vessels. Where the body is large, or the vagina narrow, I think that it should be performed in preference to the vaginal operation; but that where the uterus can be removed *whole* through the vagina, the lower route should be adopted. It would appear from the results of the vaginal operation that there is less risk of local implantation in cutting up the organ in cases of cancer of the body than when the disease affects the cervix.

2. *Abdominal Hysterectomy for Malignant Disease of the Cervix.*—In 1901 it was stated by Lameris and Kermauner (33) that in 72·7 per cent of cases of cancer of the uterus there is cancer of the parametrium, and that in 57·5 per cent of the cases the hypogastric and iliac glands are involved; that, therefore, in certainly more than half and probably in nearly three-quarters of the cases a vaginal operation would have been incomplete. Wertheim found cancerous glands in 31·7 of the cases. He has been the most persistent advocate of the abdominal operation with removal of cellular tissue and glands in cases of cancer of the cervix.

These researches upon the frequency of glandular invasion in cases of cancer are not universally accepted. Thus Robert Meyer (34) looks upon the condition found in some cases in the glands as due to irritation and not to cancer, and says he has found the same appearances in cases of eclampsia, peritonitis, and in the glands of a femoral hernia. The suspicion that these appearances ("epithelial hollow spaces" Meyer calls them) are not due to cancer is further increased by the frequency with which they are said to occur, by the discrepancy between the results of the different observers and by the discovery of tubular structures in glands in a case of squamous epithelioma of the cervix.

Basing their practice on the above-mentioned researches, Wertheim and others have given up performing vaginal hysterectomy for cancer of the cervix, and instead remove the uterus through the abdomen with its appendages, ligaments, glands, cellular tissue, and sometimes the lower ends of the ureters.

Wertheim describes the steps of his operations thus :—

1. Incision in linea alba.

2. Separation of bladder; section of round and infundibulo-pelvic ligaments.

3. Ligature and section of uterine vessels on the index finger pushed along the ureter through the parametrium to the bladder. Then exposure of the lower ends of the ureters and further separation of the bladder from the vaginal wall.

4. Separation of the rectum.

5. Division of the broad ligaments as near as possible to the pelvic wall (the ureters being held to one side).

6. Clamping the vagina (now freed on all sides) below the cancer with bent clamps and severing the vagina below them.

7. Removal of all glands however slightly enlarged.

8. Vaginal drainage with iodoform gauze; closure of peritoneum; closure of abdominal wall.

J. A. Amann (36) modifies the operation by cutting through the insertion of the recti abdominis close to the symphysis, so as to give more room. He then opens the peritoneum beyond the limit of the bladder, and after tying the appendages and cutting these from the pelvic wall, stitches the peritoneum of the anterior abdominal wall transversely to the peritoneum over the posterior wall of the pelvis and that covering the rectum, so that the abdomen is firmly closed by peritoneum over the small pelvis. After removal of the uterus, glands, and cellular tissue a gauze drain is brought out through the vagina. A Mikulicz drain to the raw spaces is also brought out of the abdomen at either sides of the recti, which are stitched to the symphysis with silver wire. He says that since he has used the Mikulicz drain he has had eleven cases with one death.

Werder (37) operates by separating the uterus and its appendages, the glands and cellular tissue around them, and the vaginal fornices, by the abdomen. The peritoneum over the bladder is then stitched to the peritoneum over the rectum so as to roof over the raw space, the cervix being meanwhile drawn down into the vagina. The uterus is then removed from below by cutting through the vagina with a thermo-cautery, and gauze is applied to the space left above the vagina.

Mackenrodt has used the cautery and claims good results.

The results of these extensive abdominal operations for cancer of the cervix have usually been very disappointing, both from the point of view of the immediate mortality and of permanent cure.

Wertheim's (38) results	were in the	1st 30	cases	12	deaths
„	„	2nd 30	„	5	„
„	„	3rd 30	„	3	„
„	„	4th 30	„	4	„
		120		24	

This gives the high immediate mortality of 20 per cent.

Of 15 cases operated on by H. W. Freund only 3 remained well after a year, and 10 were either dead or had recurrence.

Irish (39) gives 25 cases, of which 3 died as a result of the operation; 5 cases remained without recurrence for 3 years or more.

C. Jacobs (40) out of 95 cases had 6 deaths; one patient remained free from recurrence after 5 years 8 months; but no other patient for more than 2 years 7 months.

Walthard (41) has operated by Wertheim's method eight times without a death. His final results are not given.

Krönig (42), by means of the abdominal operation, has operated on 84 per cent of all cases of cancer of the uterus coming to him. He has performed the operation fifty-four times, and has eleven times removed the lower end of one ureter and implanted the upper end into the bladder. He does not give his results.

Wertheim has recently published the results of his operations after two, three, and four years. He gives the percentage free from recurrence, together with the operability percentage, *i.e.* the percentage on which he operated of all cases of cancer coming to him. From these two figures he gets the absolute percentage of freedom from recurrence, and he compares the absolute percentages thus obtained with those of Schauta, Zweifel, and Pfannenstiel as in the following table. Absolute percentage free from recurrence after:—

	Schauta.	Zweifel.	Pfannenstiel.	Wertheim.
4 years	5·1	9·5	6·8	18·8
3 ,,	6·6	10	7·1	27·5
2 ,,	8·6	11·6	...	31

He states further that all cases in which the glands were found cancerous have recurred, but that all the cases in which the glands contained hollow spaces and tubes lined with a single layer of epithelium have remained free from recurrence, pointing to the non-malignant nature of these structures.

The actual numbers of cases operated on are not given by Wertheim, but, if the figures are fairly arrived at, they indicate that a more complete removal of the local growth is possible by the abdomen than by the vagina, and that the increased number of cases free from recurrence after the abdominal operation is due to freer removal of the growth. It appears to me, therefore, that the abdominal operation is suited for those cases of carcinoma of the cervix in which the growth has extended slightly beyond the uterus so as to endanger the bladder or ureter if operation be undertaken from the vagina.[1]

C. Abdominal hysterectomy for septic uterus.—When the uterus needs removal on account of a septic condition of its contents (as in the case of a large infected fibroid which cannot be more safely removed by the vagina), the cervix should if possible be closed and isolated by the vagina and the organ then removed by the abdomen. This operation will not differ materially from the operation for cancer of the body.

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[1] Since the above was written Wertheim has published the results of operations after five years (*B. M. J.* vol. ii. 1905), and Werder, one of the pioneers of the extensive abdominal operation, has renounced it in favour of the Byrne vaginal operation with the galvano-cautery.

Some operators have recommended and practised removal of the uterus for puerperal sepsis. Mouchotte (43) publishes a list of twelve cases of abdominal hysterectomy for this condition with six deaths. It is to be hoped that this high mortality, if not consideration of the morbid anatomy, difficulty of prognosis, and lower rate of mortality of puerperal sepsis, will be sufficient to prevent the performance of the operation in the future.

HERBERT R. SPENCER.

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H. R. S.

VAGINAL HYSTERECTOMY AND COLPOTOMY

REMOVAL of the uterus *per vaginam* is, in cases suitable for the operation, attended with less danger than the removal through the abdomen, because of the slighter exposure of the peritoneum during the operation and the consequent diminution of shock. It also has the advantage over the abdominal operation that there is no abdominal scar which may give rise to hernia. Although very large uteri can be removed through the vagina, it is usual to limit the operation to uteri not larger than the head of a new-born child.

The removal of the uterus may in certain cases be supplemented by the removal of the appendages, part of the vagina, and the bases of the broad ligaments. In performing the operation for fibroids and in cases where there is no disease of the appendages, it is advisable to leave at least one ovary behind, with a view of preventing the occurrence of the symptoms of the menopause. In cases of malignant disease and of chronic suppurative disease of the appendages requiring hysterectomy, it is better to remove the appendages completely.

The chief steps in the operation are—

1. The separation of the cervix from the vagina, and the opening of the peritoneal pouches after pushing up the bladder and the ureters.
2. The separation of the body of the uterus.
3. The treatment of the wound left by the removal of the organ, and especially the treatment of the broad ligaments and their vessels.

These steps of the operation vary somewhat with the condition for which the operation is performed. As in abdominal hysterectomy, the chief conditions for which the operation is undertaken are fibroid tumours of the uterus, malignant disease of the uterus, and infective disease of the uterus or its appendages.

Vaginal hysterectomy for fibroids of the uterus.—Usually vaginal hysterectomy is unsuitable for a fibroid uterus which is larger than a fœtal head. An exception to this rule may be made where large submucous tumours can be enucleated. The cases suitable for the operation are few. Fibroid uteri which are not larger than a fœtal head can usually be treated without the removal of the organ, either temporarily by curetting, or permanently by enucleation through the cervix, which is one of the safest and most satisfactory of operations on the uterus. The cases for which the operation of vaginal hysterectomy is especially suited are small multiple fibroids causing serious hæmorrhage which cannot be controlled by milder measures.

The first essential in performing the operation is that the vagina should be sufficiently capacious to permit the necessary manipulation. In a virgin it will generally be safer to perform the abdominal operation. In any case, when the vagina is narrow it is well to dilate it by means of a large hydrostatic dilator, and sometimes it is advisable to make an incision through the perineum, or a lateral vaginal incision (Schuchardt).

The vagina having been disinfected with 1 per cent solution of formalin, and the uterus curetted and irrigated with the same solution if there is discharge from it, the cervix is seized in a volsella by the anterior lip and drawn down, a short-beaked speculum being inserted into the vagina to draw back its posterior wall. A transverse incision is made through the vagina at the insertion of the portio vaginalis in front, and another similar one behind the cervix; a silk or catgut ligature is passed by means of a Kurz needle (Fig. 277), so as to embrace the bridge of vagina at each side, and is tied, and the bridge is cut through internally to the ligature. This prevents bleeding from the lateral vaginal incision, but some operators prefer to commence by circumcising the cervix and then to tie any vessels requiring it.

With the scissors the cellular tissue in front is divided, and the bladder and ureters are pushed out of the way by the finger (further ligatures being applied to the broad ligaments if necessary) until the vesico-uterine pouch of peritoneum is reached; this is picked up and opened, and the opening enlarged with a pair of forceps or by the scissors-blades. A long narrow retractor is placed in the anterior opening thus made, and keeps the bladder and ureters out of danger. Douglas's pouch is then opened by deepening the posterior incision. The uterus is now held by the upper parts of the broad ligaments, and one of several courses may be pursued. Either (by means of Kurz's needle) ligatures may be placed on either side of the uterus close to it, and the broad ligaments cut inside the ligatures, and the uterus finally removed when the upper parts of the broad ligaments have been tied; or the uterus may be anteverted through the anterior incision or retroverted through the posterior incision and ligatures applied to the broad ligaments from above down; or the uterus may be divided along its anterior wall up to the fundus, fibroids being enucleated and wedge-shaped pieces cut out if necessary; this proceeding much facilitates the anteversion of the organ.

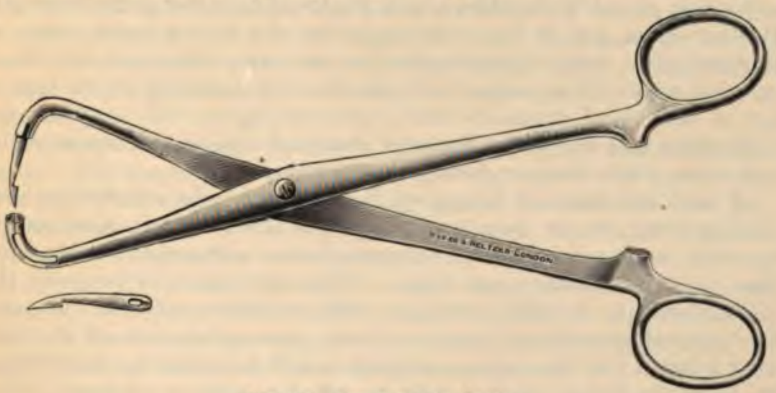

FIG. 277.—Kurz needle and holder

But, speaking generally, the best way to treat the fibroid uterus after opening the peritoneal pouches is to pass retractors into the two openings, to seize each half of the cervix in a volsella, and then with knife or scissors to divide the uterus completely into two halves in the sagittal plane. Sometimes this bisection is most easily effected by cutting through the posterior wall first, and then carrying the incision over the fundus to the anterior lip. If the two halves are seized and drawn down as the fundus and anterior wall are divided the bladder is not imperilled. The two halves are then successively drawn down into the vagina, and the broad ligaments are tied from above down with silk or catgut, the latter having the advantage that it can be cut short and does not require removal. If silk be used the threads should be strong and the ends left long. Unless the appendages are diseased it is better to leave them behind.

There are various methods of treating the wounds. Some close completely both the peritoneal and the vaginal wounds; and where the parts are aseptic and the vascularity of the tissues is not great, this is the best plan. Others leave the wounds completely open, using a light plug of iodoform gauze to drain the peritoneum. This is not a good plan, as there is considerable risk of small intestine adhering to the gauze and causing obstruction. The safest practice appears to be to close the peritoneum except at the sides where the broad ligament pedicles project into the vagina, and to leave the wound in the vagina open, a strip of iodoform gauze being lightly applied to the raw surface, and left there for a few days. It is better to draw the long ligatures on the upper part of the broad ligaments down into the vagina, and to stitch the stump there, than to cut the ligatures short and replace the stumps in the peritoneum where they are liable to cause adhesions.

If thick silk ligatures be applied they can usually be removed without difficulty after two or three weeks by slight traction; thin ligatures, on the other hand, get covered in by granulations, and sometimes break off when traction is made upon them. When the gauze is removed the vagina should be irrigated with 1 in 3000 sublimate solution by means of a large rubber catheter fitted on a large glass syringe, some of the fluid being injected into the vagina and then sucked out again by the syringe, the operation being repeated till the effluent solution is clear. This prevents over-distension of the vagina, which sometimes occurs with ordinary douching.

The results of vaginal hysterectomy for fibroids are good, but the operation is certainly rarely called for in the cases of small uteri, which, being easiest to remove, give the best results; for uteri larger than a fœtal head the operation is in some cases very difficult, both from the point of view of the removal of the organ and of the complete control of hæmorrhage. The method of lighting the pelvis by electric lamps introduced through a speculum, which was devised by von Ott of St. Petersburg, is calculated to lessen the risk from this source. Von Ott by means of a special table elevates to an extreme degree the pelvis of the patient, who lies in the dorsal position, so that air enters the peritoneum as a result of the falling of the intestines towards the diaphragm; small electric lights are introduced into the peritoneum through the opening which has been made, and hæmorrhage, adhesions, etc., are dealt with after inspection. This method has yielded excellent results in the hands of its originator, and appears to me to be one of the greatest advances made during recent years in the treatment of pelvic disease by operation through the vagina.

Vaginal hysterectomy for cancer.—In cases of *cancer of the body* the vaginal operation competes with the abdominal. If the vagina is narrow or the uterus large, the abdominal operation is to be preferred; on the other hand, if the uterus is small and the vagina large, the vaginal operation is better, giving equally good final results, and being attended with less immediate risk to life.

The uterus should be curetted and the cervix closed, as recommended in the abdominal operation, and the uterus should be removed in one piece, if possible, to prevent the risk of local implantation of cancer cells. It is the uncertainty whether it will be possible to keep the uterus entire that has led some gynæcologists (myself among them) to perform the abdominal (and especially the vagino-abdominal) operation more frequently. The steps of the operation are much as in the case of fibroids, except that the organ is kept entire, being drawn down by a powerful many-toothed volsella, which also forms an additional means of closing the cervical canal. The broad ligament must, when possible, be tied from below upwards, unless the body can be anteverted or retroverted without incurring great risk of tearing the organ or of squeezing out its contents.

Some operators prefer forceps to ligatures to control the broad ligaments. The ligatures are preferable in that they cause the patient less pain and inconvenience, and that they permit the closure of the peritoneum in the centre of the wound. The forceps may cause injury to adjacent coils of intestine unless great care is taken to protect the ends with gauze. It is best to put the forceps in the upper part of the broad ligament from above downwards, so that the ends of the forceps are buried in the broad ligament. I prefer strong ordinary forceps to the special forceps with bowed blades designed by Doyen.

If forceps are used they should be taken off on the second or third day, and I prefer to leave an iodoform gauze plug in the vagina for about a week after operation.

Cancer of the cervix is the disease for which vaginal hysterectomy is most frequently performed. The immediate mortality is small (certainly less than five per cent) in the hands of skilful operators; but large statistics show that not more than ten per cent of cases of cancer of the cervix can be "cured" by vaginal hysterectomy as ordinarily performed.

Certain skilful operators have had extremely unsatisfactory results as regards "cure" of the disease. Thus Jacobs (1), out of 82 cases of vaginal hysterectomy (with one death from operation), had no patient free from recurrence after a year; Morisani (2), of 25 vaginal hysterectomies (no death from the operation), had recurrence in every case after a year; Halliday Croom (3), of 14 specially selected early cases (one death), had no case free from recurrence after the same period; *i.e.* they had together 121 cases with two deaths from operation, but recurrence in all the survivors within a year. Pozzi (4) says he has only had two patients survive for five years out of 204 operations. On the other hand, the late Dr. John Byrne (5) had the most splendid results, both immediate and remote, after the simple operation of supra-vaginal amputation of the cervix with the galvano-cautery. In nearly 400 cases he had not a single death due to the operation; in 40 out of 63 cases of cancer of the portio vaginalis (23 having strayed away), there were periods of exemption from recurrence ranging from two to twenty-two years; and of 81 cases involving the entire cervix, 31 were lost sight of, 10 relapsed within two years, 5 had no recurrence for two years, 11 for three years, 6 for four years, 8 for five years, 6 for seven years, 2 for eleven years, 1 for thirteen years, 1 for seventeen years. Thus of 40 of this class whose histories could be followed up there was an average period of exemption for each of nearly six years.

J. W. Hyde (6) published 3 cases in which he removed the cervix for malignant disease with the galvano-cautery. The patients remained free from recurrence after eight years, eleven years, and five years.

W. H. Baker (7) amputated the cervix, and afterwards applied the actual cautery in 10 cases; four of the patients remained free from recurrence after twenty years.

Lewers (8), out of thirty-three operated on (without a death) by high amputation of the cervix for cancer, had eight patients who remained free from recurrence for from four to fifteen years, and of twenty-eight operated on by vaginal hysterectomy (with four deaths) had six patients who remained free from recurrence for from four to seven years after the operation; of the sixty-one patients 10 to 16 per cent remained well over five years. Lewers uses the Pacquelin cautery to cut off the cervix in the high amputation, and to sear the vaginal incision in vaginal hysterectomy.

I regret to say I am unable to give my own late results; but I have not lost a case of high amputation from the operation, and I believe only one from vaginal hysterectomy for cancer of the cervix in over seventeen years. I used to employ the Pacquelin cautery both to sever the vagina and to remove the cervix, but for some years have used the galvano-cautery (which is far to be preferred), both for high amputation and for vaginal hysterectomy. I (9) can only give my late results for cancer of the cervix complicating advanced pregnancy. Of six cases which have come under my care three only were in the operable stage; they were treated by high amputation of the cervix after delivery through the natural passages, and remain free from recurrence after eleven, eight and a half, and eight years. In two of these cases the Pacquelin cautery was used.

The conclusion at which I have arrived after a careful consideration of the above facts, is that the difference in the results obtained by gynæcologists in the treatment of cancer of the cervix is not dependent upon skill or experience, but upon radical difference in technique; that the most important point in the technique is the prevention of local implantation of cancer cells, and that one of the best means of preventing that implantation is the use of the cautery, especially the galvano-cautery.

Incidentally I have also come to the conclusion that high amputation is the safest and most satisfactory operation for cancer of the portio vaginalis, the only objections to it being the occurrence of contraction of the scar and subsequent dysmenorrhœa (which is common), or hæmatometra or pyometra (which are rare), and also the occasional, though very rare, occurrence of cancer of the body in association with cancer of the cervix. The dysmenorrhœa is usually not great and is easily treated, and the general condition of a young woman who menstruates with dysmenorrhœa is usually better than that of one who does not menstruate owing to the absence of the uterus. Whether the disadvantages of high amputation outweigh its advantages is a question about which authorities will differ; but personally I consider there are many cases in which it is the best operation for cancer of the portio vaginalis; for glandular cancer, for cases where the peritoneum is extensively opened or bleeding is difficult to stop, or where fibroids are also present, vaginal hysterectomy is preferable.

In most cases of vaginal hysterectomy for cervical cancer, however, I prefer to first remove the cervix by high amputation with the galvano-cautery, and immediately afterwards to remove the body; this is done with a view of preventing local implantation of cancer cells. In some cases where the uterus is small and the growth in the early stage, and contact of the growth with the cut surfaces can easily be avoided, I remove the uterus entire by means of the galvano-cautery, neither scissors nor scalpel being employed.

The vagina is irrigated for two days previously to operation with 1 per cent solution of formalin. At the operation sometimes stronger solutions (up to 10 per cent) are used to swab the cervix if the growth is foul. Then the surface of the growth, if foul or bleeding much, is cauterised by means of a thick red-hot poker. A short-billed metal speculum is then passed, and the anterior lip of the cervix seized with a strong two-pronged volsella and drawn down. With the galvano-cautery a transverse cut is made at the junction of cervix and vagina in front and behind, and at least a quarter of an inch from the growth; similar cuts are made at the side, the knife being applied cold and the current gradually turned on to a red heat. Crank-handled narrow retractors are used to expose the parts to be cut (Fig. 279). One of these is slipped into the anterior incision and presses up the bladder, and on making slight cuts with the cautery through the stretched cellular tissue the flap and bladder are easily pushed up. The incision is, of course, carried round at the same level on all sides, care being taken not to open Douglas's pouch if it can be avoided. The knife edge is kept on to the uterus, and about half an inch above the vaginal insertion it is made to cut gradually into the uterus so as to remove a conical piece which is finally cut off above the internal os. After the cervix is removed a curette should be put into the body to see if there is any growth there: in many cases the little finger may be inserted to ascertain this. By drawing on the cervix the whole of the mucous membrane and practically the whole of the uterus may be removed without opening the peritoneum; but usually it is sufficient to amputate the organ a little above the internal os. Often it is unnecessary to tie any vessel, the bleeding being very slight as a rule; but if the uterine arteries are large or cannot be controlled with the cautery they may be seized and tied with silk or catgut after the cervix has been removed, or a pair of Spencer Wells's forceps may be left on for two or three days. I usually leave in the vagina a strip of iodoform gauze, though this is not necessary.

If it is thought advisable to remove the body as well, after the cervix has been removed the stump of the uterus is seized with a volsella (which has not been in contact with the growth) and is drawn down, the anterior and posterior pouches are opened, and the case treated as described under "Vaginal Hysterectomy for Fibroids" (p. 910). In cases where I remove the uterus whole with the galvano-cautery, after separating the cervix from the bladder and broad ligaments I open the anterior and posterior peritoneal pouches, seize the broad ligaments with forceps, cut away the body with the galvano-cautery, apply ligatures of thick silk to the upper parts of the broad ligaments, bring the stumps down into the vagina, close the peritoneum in the middle line and pack lightly with iodoform gauze. Throughout the operation great care is taken that no instrument which has touched the growth is brought in contact with the raw surfaces. In any cases where the vagina is narrow the operation is much facilitated if a median or lateral incision be made into the vagina. But this should be avoided, if possible, owing to the risk of local implantation of cancer cells.

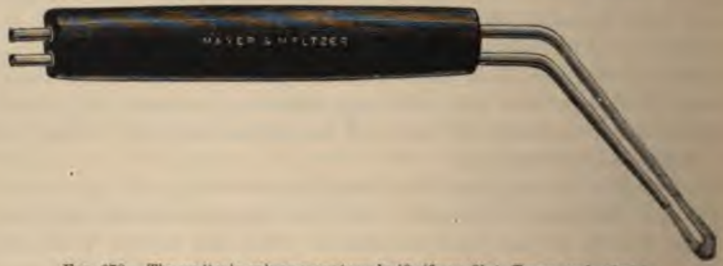

FIG. 278.—The writer's galvano-cautery knife (from *Obst. Trans.* vol. xlvi.).

In performing hysterectomy by means of the galvano-cautery a large cautery-knife should be used; this necessitates a special transformer if the current be taken from the ordinary installation. In cases where the continuous current is installed a rotatory transformer wound to heat cauteries up to 30 ampères, is the best and most reliable. The one I use at University College Hospital I obtained from America on the recommendation of the late John Byrne. I have designed and had constructed a cautery-knife in which the knife and handle are in one piece (Fig. 278). The handle is made of non-conductive vegetable fibre and insulates the wires. The advantage of this knife is that it can be sterilized by boiling, and there is no trouble from loose points or faulty insulation.

In cases where electricity is not installed, the cautery can be heated by accumulators, of which two or three should be at hand in case one fails.

The Pacquelin cautery may be used instead of the galvano-cautery,

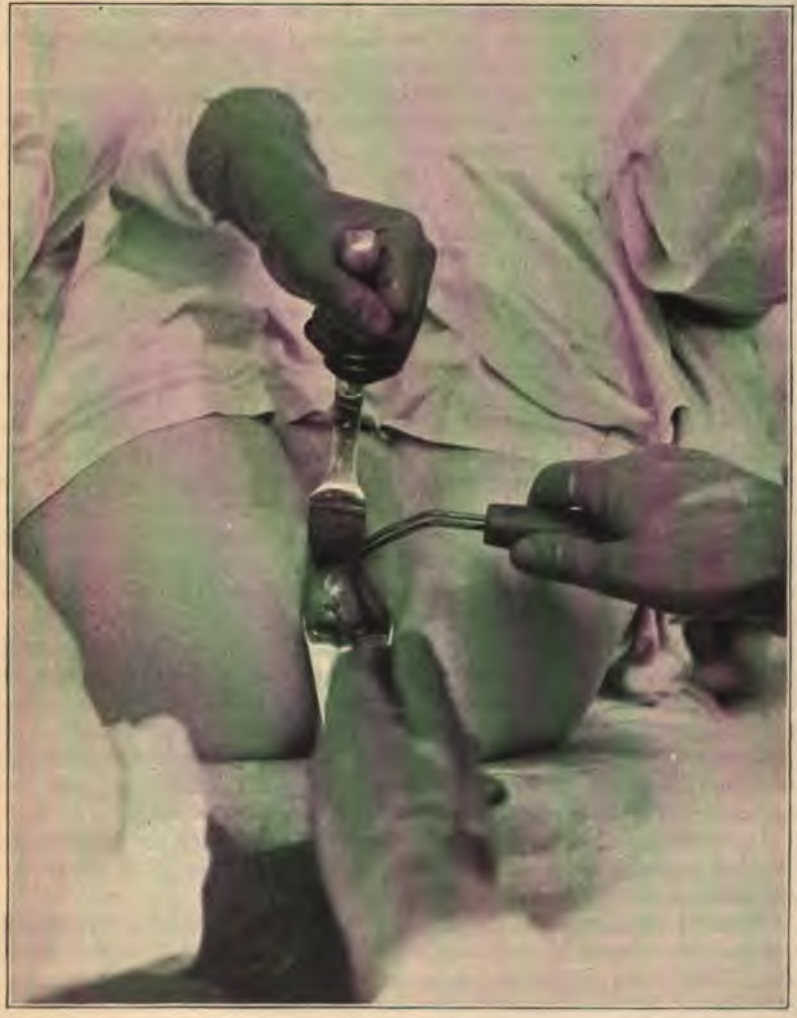

FIG. 279.—Illustrating first stage of high amputation and vaginal hysterectomy with galvano-cautery.

but is inferior to it in asepticity and power of stopping hæmorrhage. Those who do not fear local implantation will continue to use the ordinary knife and scissors. Personally, I think it is probably the chief cause of recurrence in early cases. Evidence in favour of the occurrence of local implantation ("Impfmetastase") may be found in papers by Winter (10), Schopf (11), W. A. Russell (12), Schaeffer (13), Cullen (14), and others.

Vaginal hysterectomy for cancer of the cervix complicating pregnancy.—Although many operations have been done by the abdomen for cancer complicating pregnancy, the best results have been obtained by vaginal operations.

In the early months the uterus may be removed intact per vaginam; but I think it is preferable to perform high amputation with the galvano-cautery, and immediately afterwards to remove the ovum and body of the uterus.

In the last two months of pregnancy the uterus is too large for removal intact. If the pregnancy is some weeks short of term, labour should be induced, otherwise labour should be allowed to occur spontaneously, the cervix being dilated if necessary with de Ribes's bag or perhaps by small incisions with the galvano-cautery; the cervix, and, if thought necessary, the body of the uterus, should be removed during the puerperium through the vagina by the galvano-cautery. As far as I know, only five cases of advanced pregnancy complicated by cancer of the cervix have remained well for five years after operation, viz., Olshausen's (15), 5¾ years; v. Ott's (16), 8½ years; and three of my own cases, 11, 8½, 8 years (9). They were all operated on by the vagina in the puerperium or shortly after. In two of my cases the cautery was used.

Olshausen has suggested Cæsarean section in these cases, followed by vaginal hysterectomy; and Fehling advises Cæsarean section followed by amputation above an elastic ligature, followed by excision of the cervix per vaginam.

As an alternative it might be well in operable cases when the cervix will not dilate, to excise the cervix by means of the galvano-cautery, and then to remove the child and the body of the uterus either by the vagina or the abdomen.

Cæsarean section, followed by total abdominal hysterectomy, has been performed; but the mortality is very high, and I believe no case has remained well for a long period subsequent to the operation.

It should, I think, be limited to those cases in which the growth has extended slightly beyond the cervix, but not so far as to preclude the possibility of cure; such cases are rare.

Vaginal hysterectomy for infective disease.—It has been proposed to remove the uterus by vaginal hysterectomy in cases of puerperal infection. The same objections may be urged as against the abdominal operation, except that the mortality is somewhat less. J. Mouchotte (17) gives a list of eighteen vaginal hysterectomies, with eleven recoveries and seven deaths. In spite of Hirst's (18) list of twelve cases with eleven recoveries, in my opinion the operation is not justifiable, having a higher mortality than the disease for which it is performed, and causing the mutilation of many women who would have recovered completely without the operation.

When the uterus contains an infected fibroid it is generally better to remove the fibroid if it is a submucous tumour and to leave the uterus. But if there is reason to suppose that the wall of the uterus is invaded by the infection it may be better to remove the uterus. Great care should be taken by the use of formalin solution, etc., to minimise the risk of peritoneal infection.

Of late years it has been proposed to remove the uterus in cases of bilateral inflammatory disease of the appendages (see p. 879). The operation has been too frequently performed, especially on the Continent and in America. In certain cases it has its value, chiefly in affording free drainage.

The best method of performing it is that recommended by Pryor (19). After the usual preliminaries he bisects the uterus, introduces the whole hand into the peritoneum, separates the adhesions around the appendages of each half, applies two pairs of forceps to each broad ligament, and carefully inserts a strip of iodoform gauze. The results of the operation in the hands of Pryor have been remarkable, only 1 patient out of 228 dying from the operation.

Vaginal hysterectomy for the prolapsed or inverted uterus.—Vaginal hysterectomy for prolapse is a serious operation for a slight ailment which is generally amenable to milder measures. Moreover it is often useless; for the removal of the uterus in these cases may be followed by prolapse of the intestines, from which the patient may suffer as much as from her previous ailment. Although I have not performed the operation for this condition, I think that certain cases of severe procidentia of the uterus occurring in elderly widows might be treated with benefit by the removal of the uterus and the vagina.

The cases of inversion of the uterus which cannot be replaced by Aveling's repositor are very rare; personally I have never seen one. If such cases exist they may be treated by conservative operation in most cases. If hysterectomy be ever necessary the operation is simple. All that is required is to bisect the inverted organ, tie each broad ligament and cut away the uterus, and treat the wound as after hysterectomy for fibroid.

COLPOTOMY

Colpotomy or Vaginal Cœliotomy is the operation of opening the peritoneal cavity by the vagina either through the anterior or posterior pouch of peritoneum; hence it is divided into anterior and posterior colpotomy. These operations are, of course, necessarily performed during the operation of vaginal hysterectomy; but it has been suggested that the operation is often advisable for the diagnosis and cure of morbid conditions outside the uterus.

The operation of posterior colpotomy has been performed for generations for the opening of pelvic abscesses and hæmatoceles; anterior colpotomy is of recent date, and has been largely practised by Dührssen and A. Martin, who claim for it superiority over the posterior operation. For abscesses the posterior (Douglas's) pouch only should be opened; any intra-peritoneal abscess in front of the uterus is more safely opened from the abdomen.

The method of opening pelvic abscesses behind the uterus, which I have employed for seventeen years, is the following:—a fine pointed pair of forceps, "Lister's sinus forceps," is held in the palm of the hand, the closed point lying along the right index finger; the finger is passed till it presses on the most prominent part of Douglas's pouch in the middle line; the point is then passed through the vagina for about an inch by the pressure of the palm of the hand; the blades are opened and so withdrawn, the finger alone is then passed into the abscess cavity and gently breaks down bands in it. The abscess cavity being evacuated is gently irrigated with hot, mild antiseptic, or salt solution, and a drainage tube is inserted. The best tube for this purpose is a T-shaped tube, the cross of the T being made by a flat flange about an inch long (Fig. 280). Into the tube is fitted a piece of glass tubing rather larger than the rubber tube, so that it fits tightly. The glass tube should be about ½ inch in diameter, and of the same length as the rubber tube. The flanges are pressed together in the blades of long forceps, and the end of the tube is thus carried into the cavity; then on removing the forceps the flange retains the tube, the lower end just projecting at the vulva. The cavity is easily washed out by means of a small catheter passed through the glass tube, the catheter being attached to the tube of an irrigator. When the cavity is closing, and there is little discharge, the tube may be withdrawn by slight traction. The same treatment may be adopted for hæmatoceles, but it is rarely necessary or advisable to open these unless they become infected.

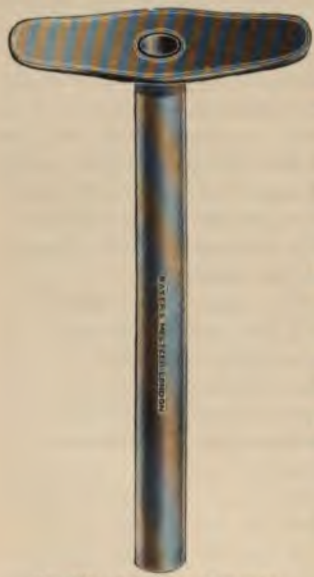

FIG. 280.—Pelvic drainage-tube.

The posterior pouch may be opened for diagnostic purposes; for instance, it is the simplest means of making sure of the presence of intra-peritoneal hæmorrhage in a doubtful case of ruptured tubal pregnancy. It has also been opened for the purpose of palpating the appendages and ascertaining their condition, and for the removal of small tubal or ovarian tumours. Small tumours lying behind the uterus, whether uterine fibroids, ovarian or tubal tumours, may be easily removed in this way. If a fibroid tumour is enucleated it will generally be wise to drain the cavity with gauze; if the tumour be ovarian or tubal, the vaginal incision may be closed, after ligature of the pedicle and removal of the tumour, or, if preferred, a gauze drain may be used for a few days.

The danger of this operation lies in the difficulty of preventing subsequent oozing in cases where there are adhesions. I have published a case where it was necessary to open the abdomen on this account.

The operation has been especially recommended, and has been often successfully performed during pregnancy or labour for ovarian tumours impacted in the pelvis; but the difficulty of tying the pedicle, and especially of separate ligation of the pedicle vessels in these cases, owing to the tension on the broad ligament, the risk of the child's head being forced down during the operation if undertaken during labour, and the impossibility of examining the other ovary by the vagina, render it likely to prove more dangerous and less satisfactory than abdominal ovariotomy. For the removal of tumours, the cervix is drawn forwards and Douglas's pouch is opened by a transverse incision just behind the cervix.

Anterior colpotomy has been especially advised for examining and removing small tumours of the appendages, for the purpose of stitching up prolapsed ovaries, or for the performance of vaginal fixation. The incision is made in front of the cervix. In direction it may be either longitudinal or transverse, or it may be T-shaped. The bladder and ureters are pushed forwards until the pouch of peritoneum is reached; this is seized with forceps and opened. The finger is then introduced, to explore the surface of the uterus and the appendages; adhesions, if present, are separated and small tumours may be removed. It may be necessary to antevert the fundus, either by means of a sound or by traction with a volsella through the opening, and to replace it afterwards.

Bilateral adherent tumours of the ovaries or tubes have been removed, but the operation is much more difficult than if the uterus were removed at the same time, and is not more satisfactory. (*Vide* article "Ovariotomy," p. 874).

Very large ovarian tumours have been removed through colpotomy-incisions, especially by von Ott (20), under the guidance of electric lamps introduced into the peritoneum, and I think the operation is indicated in the case of some simple cysts which are freely movable. But at the present time, when the removal of such cysts by the abdomen is almost free from risk, I think most operators will prefer the abdominal operation, the indications and technique of which are better known. Yet the slight risk, the absence of shock and of an abdominal scar, render the operation of colpotomy very attractive, and I predict that it will become more popular when von Ott's electric illumination of the peritoneum is more widely practised.

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H. R. S.

THE AFTER-TREATMENT OF GYNÆCOLOGICAL OPERATIONS

I. **Abdominal Section.**—Whether a patient upon whom abdominal section has been performed is to recover or to die has in most cases been decided by the time the abdomen has been closed: after-treatment but little affects the final issue. But there are a few cases in which recovery or death depends on right treatment after the operation; and in all cases the comfort of the patient almost entirely depends upon the after-treatment. The problems of the after-treatment are thus of two kinds: (*a*) to promote the patient's comfort; and (*b*) to prevent or treat certain complications.

During the twelve hours, or more, following abdominal section, patients suffer from three things: (1) vomiting, (2) thirst, (3) pain.

(1) *The vomiting* is the result, partly of the operation, partly of the anæsthetic. It is partly the result of the operation, for it is not so frequent nor so troublesome after operations on other parts of the body as it is after abdominal operations. It is partly the result of the anæsthetic, for it depends much on the anæsthetic given and the duration of the anæsthesia. Anæsthetic vomiting is best avoided or lessened by letting the anæsthetist choose what anæsthetic he will give. He is responsible, and therefore ought to have the choice; and he has probably more carefully studied the effects of different anæsthetics on different classes of patients, than one who gives anæsthetics less frequently. The vomiting is a symptom of gastric catarrh; and when it has ceased, loss of appetite and furring of the tongue persist. The best treatment for anæsthetic vomiting is to keep the stomach empty. But, unfortunately, this is not always the pleasantest thing for the patient, as will appear in the next paragraph.

(2) *Thirst.* After every intra-peritoneal operation the patient is very thirsty. Yet were she allowed unstinted draughts of fluid, the probability is that vomiting would be more frequent. Vomiting after abdominal section is a grave evil; it throws strain on the abdominal sutures, and thus favours the occurrence of stitch-hole abscesses. It raises the tension within the abdomen, forces down the pelvic floor, and may thus favour the slipping

of an insecurely-tied pedicle ligature. If it occurs after the stitches have been removed, it may cause the wound to break open and bowel to protrude. To avoid these evils, all operators, so far as I know, restrict the diet during at least the first twelve hours. But it is not necessary to let the patient be tortured with thirst. She may without harm take water, either hot, cold, iced, or aerated, as she may prefer, in spoonfuls, so long as it does not provoke retching. A half-pint of warm water or of warm normal saline solution, administered by the rectum, effectually relieves thirst. When vomiting has ceased, water may be replaced or supplemented by milk, which may be diluted with water or soda-water or peptonised, as the patient may prefer. If the patient is able to keep down milk, spoonfuls of beef-tea may be interposed between those of milk. The patient should be fed as often as her appetite dictates. If she is asked what she would like, she will generally say "a cup of tea." If she is not sick, there is no objection to her having this. When appetite returns, which will not be till the fourth or fifth day, the patient may have bread and butter, bread and milk, beaten-up eggs; then boiled fish, and at the end of the week she may get back to her ordinary diet.

(3) *Pain.* An abdominal section is always followed by pain. This pain is intestinal colic. The peristaltic movements of the bowel are painful, because the resistance of the central nervous system is reduced by the shock of the operation and the anxiety of preparation for it. This pain is not always so severe as to prevent sleep; and if the patient can sleep, it is better not to give a narcotic. But if the pain prevents sleep, morphia, in doses of $\frac{1}{6}$th to $\frac{1}{3}$rd of a grain, must be given hypodermically to relieve it. The relief, as much as possible, of vomiting, thirst, and pain, is the aim of treatment during the first twenty-four hours.

Some surgeons think it necessary to have the catheter passed every few hours during the day or two following the operation. I find that patients can generally pass urine naturally, and I think it better that they should do so; for frequent catheterism brings with it the risk of cystitis. If the patient cannot pass urine, relief should be given with the catheter as soon as discomfort arises.

Cystitis is an occasional sequence of retention of urine and catheterism. It is produced by the introduction of micro-organisms by a catheter not surgically clean. To prevent its occurrence, the vulva, before the catheter is passed, should be wiped with cotton wool dipped in 1-2000 solution of corrosive sublimate. The catheter should be kept in a 1-1000 solution of corrosive sublimate. Before introduction it should be wiped dry, and then lubricated with 1-2000 solution of corrosive sublimate in glycerine. But cystitis occasionally occurs, although every ordinary precaution has been prescribed and apparently taken.

When cystitis has arisen, shown by the urine being alkaline and containing pus, urotropine, in $7\frac{1}{2}$ grain doses, should be given by the mouth, and the bladder should be washed out daily with a saturated solution of boracic acid.

The *pulse* is quickest during the twelve hours after the operation.

Its quickness depends upon the rate of pulse before the operation, the length of the operation, and the amount of blood lost. After twelve hours the pulse should become less frequent; if it becomes more frequent, this is a very grave sign, unless the quickening be merely temporary, and plainly due to nervous excitement.

The *temperature* should not exceed 100° F. It may from some temporary cause rise for two or three hours above this; but a steadily-rising pulse and temperature give cause for the gravest anxiety. Elevation of temperature five or six days after the operation, without very great acceleration of pulse, should suggest the probability of stitch-hole suppuration. The wound should be examined, and if there is suppuration along the track of any stitch, it should be removed.

If on the second day following the operation vomiting has ceased, and the patient is taking liquid nutriment well, the next thing is to get the bowels to act, and so eliminate the danger of intestinal obstruction. I think the best aperient is sulphate of magnesia, given with some carminative such as cinnamon or peppermint, to disguise its taste, in drachm doses every hour until it has acted, or discomfort indicates that it is probably about to act. If no action follows, then an enema of half an ounce of turpentine, an ounce of castor oil, and a pint of soap and water, should be thrown up the bowel as far as possible. By these means peristalsis may be started, and when once started it will in all probability continue.

In England it is customary for the patient to remain recumbent in bed for ten days after abdominal section. Some even insist that during this period the patient should lie upon her back, without turning to either side. I see no reason for inflicting this irksome restraint upon the patient, for I know of no harm that follows a slight change in position. Accounts have been published in America and in Australia of cases in which patients have been allowed to get up on the day following an abdominal section; and I have been told of such cases. I accept these statements as showing that this practice is not fatal. But I am sure that a patient during the few days following an abdominal section is not fit to perform any domestic or social duty, even though she be able to stand or sit; that she is far more comfortable in bed; and that convalescence will go on faster and better if the patient is allowed to rest until her nervous energy has so far returned that longer recumbency is distasteful to her.

On the eighth day the dressings should be removed, and the wound looked at. If there is much redness and swelling of the parts between the stitches, they should be removed; if not, they should be left till the ninth or tenth day. After the stitches have been removed, in order to prevent the wound from bursting open if the patient should violently cough or vomit, it should be supported by strapping. The two pieces of strapping, 6 inches broad and 24 inches long, should be cut to the shape shown on following page (Fig. 281). The broad surfaces should be placed under the back, and the long strips brought from opposite sides and interlaced across the wound, which should be protected by a strip of gauze. The strapping should be then covered by a binder. When this has been done, the patient may leave her bed as soon as she pleases; first to lie on a couch, then to sit in an arm-chair, finally to stand and walk about. The strapping should be worn until it gets loose; and if by that time cicatrization of the wound is not complete, it should be replaced by fresh strapping. If the tumour removed was a big one, so that the belly wall was greatly stretched, and after removal of the strapping is very loose and yielding, the patient should be advised to wear an abdominal belt. If the belly wall has not been stretched, but is firm, a belt is unnecessary. The patient should be instructed to wear the belt so long as she finds comfort from the support it gives.

When the patient is beginning to get up, some tonic medication will be advisable, such as iron, quinine, nux vomica, or hypophosphites; and when convalescence is complete, she should be prepared for a resumption of her domestic and social duties by the best of all tonics, viz. a change of air and scene.

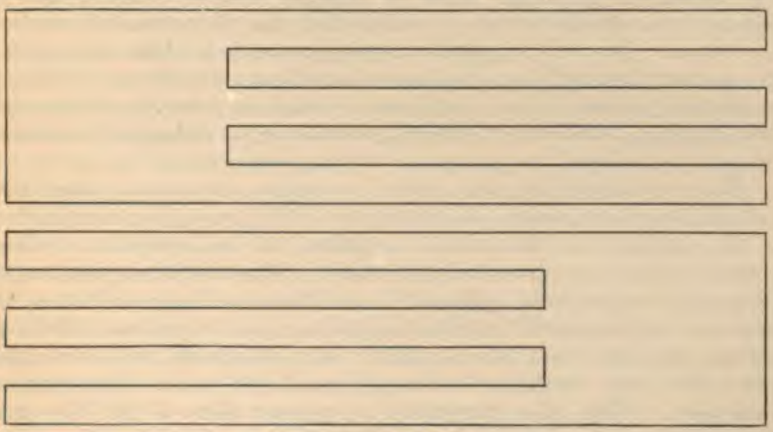

FIG. 281.—Strapping-plaster for the abdominal wound.

Drainage.—The object of drainage is to provide for the escape of noxious fluid. It is now much less used than it was fifteen or twenty years ago. Its use after abdominal section is practically limited to cases in which the operator opens a suppurated cavity, the walls of which he finds it impossible to remove. Drainage is effected by placing in the cavity a glass tube (Keith's) or an india-rubber tube, either of them being of about the thickness of the finger, and having holes in its side. One end of the tube lies in the cavity, the other in the abdominal wound. When this has been done, the nurse should every few hours suck up with a syringe, having attached to it about a foot of india-rubber tubing of a smaller size than the drainage tube, the fluid that has accumulated in this tube. How frequently this must be done depends on the amount of the fluid and the condition of the patient. If there is but little fluid it is not necessary to disturb the patient so often as if there is much. By the end of forty-eight hours the drainage tube will be surrounded by adhesions shutting off the cavity in which it lies from the general peritoneal cavity. It may then be removed and replaced by a strip of gauze, carried down by a probe to the bottom of the cavity. This will keep open a track along which discharge can flow out. The strip of gauze is changed daily until the cavity so fills up that the gauze can no longer enter it. This is one mode of drainage. Many operators now think it better, in the first instance, to pack the cavity with a long strip of iodoform gauze. The iodine given off from this acts as an antiseptic. The gauze may be left untouched for a week, or even longer. By that time it will be bathed in pus, the walls of the cavity in which it lies will be covered with granulation tissue, the gauze can then be removed without difficulty, and be replaced by a slender strip to ensure that the cavity shall fill up from the bottom. The only exception to this practice is in those rare patients who are very susceptible to the poisonous effects of iodoform. In them, by the third or fourth day, symptoms of iodoform poisoning—very rapid pulse, delirium, but without vomiting, distension, or abdominal tenderness—may arise. If so, the gauze must be removed at once.

The first danger, in point of time, to which a patient is exposed after abdominal section is that of *hæmorrhage*. This arises from some failure in the methods of hæmostasis employed at the operation. These methods have been described elsewhere. When internal bleeding is going on, it begins to be apparent in the first few hours following the operation. The patient feels faint and weak, and is restless. Her face and mucous membranes become pallid; her nose, cheeks, and extremities cold. Her pulse becomes increasingly small and quick. There is not much pain. When these symptoms are present there is but one treatment, viz. to re-open the abdomen, find and secure the bleeding point. Clot should be turned out, and the pedicle or stump examined, for it is probably from it that the bleeding comes. After this has been done, the amount of fluid in the patient's vessels may be increased by injecting normal saline fluid into a vein, or into the cellular tissue between the scapulæ or under the breasts; or, which will be more quickly effectual, pouring it into the peritoneal cavity. But this is useless until the bleeding has been stopped.

Vomiting from the anæsthetic should cease within twelve or at most twenty-four hours' time. If it persists longer, it is from one of three causes: (1) Idiosyncrasy. (2) Peritonitis. (3) Intestinal obstruction.

(1) *Idiosyncrasy.*—Some patients are made to vomit very easily; those, for instance, who are subject to frequently recurring "bilious attacks": some cannot travel without being sick: and there is such a thing as hysterical vomiting. A patient having one of these peculiarities may vomit everything she takes for many days after an operation. It may be difficult to judge whether such persistent vomiting is due only to the patient's idiosyncrasy, or is from peritonitis. Want of food,

thirst, and retching make the patient weak and faint, and cause her pulse to become quick. But the pulse is not so quick as in peritonitis: the facial expression is not anxious: the abdomen is not distended: the amount of the vomit does not, as in peritonitis, increase and become green, but diminishes.

In the treatment of this kind of vomiting there are but two measures that in my judgment are effective. The usual gastric sedatives may be given, such as bismuth, hydrocyanic acid, effervescing draughts, etc.: but there is no drug than can be relied upon. The two effective measures are to get the bowels open, and to keep the stomach empty. If the sulphate of magnesia recommended in a former paragraph is vomited, then instead a grain of calomel should be given every hour, until normal peristalsis has been established. No food should be given by the mouth, and the patient's strength should be maintained by nutrient enemata. If infective peritonitis is not present the vomiting will sooner or later cease, and appetite reappear.

(2) *Peritonitis.*—Every operation upon organs within the abdomen is followed by adhesive peritonitis: it is the means by which wounds are healed and ligatures encapsuled and absorbed. Such slight adhesive peritonitis causes no unfavourable symptoms. But there may be peritonitis of such severity as to lead to the effusion of serum or pus. In such cases there will usually (but not invariably) be rise of temperature, always quick, small, hard pulse, pain, thirst, dry brown tongue, and vomiting. These symptoms may last for days, gradually becoming worse. If a vaginal examination is made, the exuded serum or pus may be felt behind the uterus, in Douglas's pouch. These are the cases that may be saved by timely intervention. The fixity of the swelling indicates that the fluid is encysted by adhesions above. It can therefore be opened by the vagina without risk of fouling the general peritoneal cavity. This therefore should be done. A small opening should be made at the point where the swelling most bulges into the vagina; and when the fluid has been reached the incision should be enlarged by tearing with fingers or forceps (Hilton's method) so as to get a free opening without much bleeding. After the fluid has had exit, the cavity should be lightly packed with iodoform gauze, to prevent the opening from closing and to get the antiseptic effect of the drug. Rapid improvement will usually follow.

If the symptoms indicate peritonitis which is getting worse, and no swelling can be felt in Douglas's pouch; and if, as is usual in such cases, the abdominal wall is so rigid that no information can be gained as to what is within it, the patient should be anæsthetised, and careful examination made to find any localised swelling. If there be, and it is above the pelvis, it will probably be near the incision; and if this is so, it may be possible, by reopening the wound in the right situation, to liberate the serum or pus without infecting the general peritoneal cavity. The result will then be good. Some operators have opened the general peritoneal cavity, and then sought for the focus of inflammation, liberated the inflammatory products, and drained the cavity; but the result has generally been disastrous, for it has led to the introduction into the general peritoneal cavity of infective fluid which before the intervention was shut off from it by adhesions.

Abdominal section may be (and in pre-antiseptic days often was) followed by peritonitis so acute that the patient dies before enough inflammatory exudation has been poured out to form a localised swelling. In these cases the symptoms become marked within twenty-four hours after the operation. The vomiting which followed the anæsthetic becomes more frequent; the vomited matter becomes increased in quantity and green in colour; the pulse becomes hard, small, and steadily increases in frequency; usually, but not always, the temperature rises; the abdomen becomes more and more distended and hard; the facial expression becomes anxious; the tongue dry and brown; the nose and extremities cold; and the patient usually dies within forty-eight hours.

These symptoms are produced, it is believed, by infection with streptococci. An anti-streptococcic serum has been prepared, by which it is thought the effects of streptococci can be counteracted; and cases have been published in which there seems reason to think that this was done. But, unfortunately, it appears as if there were not one, but many, streptococci: some very virulent, others hardly virulent at all; and bacteriologists are not yet able to distinguish between them. It follows that there may be different kinds of anti-streptococcic serum: some very powerful, some almost inert. Hence in using anti-streptococcic serum we are using a remedy the effect of which we cannot predict: it may save the patient, or it may utterly fail. The ill effects attributed to the serum are trifling, and as uncertain as the curative effects. As in the bad cases just described, the patient if left untreated is certain to die; I think that anti-streptococcic serum should be injected as soon as the nature of the case is plain. The best variety of anti-streptococcic serum now obtainable is the *polyvalent* serum, which is prepared from an admixture of different varieties of streptococci.

Re-opening the abdomen where there is no evidence of any local collection of inflammatory exudation to be dealt with is useless. A German writer says it has the advantage of shortening the patient's sufferings.

A mode of treatment has recently been introduced from which surgeons entertain much hope. It is the injection of large quantities of saline solution into the cellular tissue. I describe what appears to me to be the simplest and therefore best way of doing it, which is that devised by Barnard.[1] A saline solution is made of a teaspoonful of common salt in each pint of water. The water should have been boiled. The solution is put in a large jug which has been scalded out. An india-rubber tube, about four feet in length, weighted at one end, at the other carries the fluid to a glass T piece. This is connected by two further lengths of rubber tubing to two stout brandy syringe needles. This apparatus has all been boiled. The jug is placed about a foot above the level of the patient's body: if it is at a greater height than this the injection gives pain. A syphon action is established by immersing the whole of the tubing in the ewer and then clipping the ends. Then the needles are inserted under the skin of the thighs, or under the breasts. Where the needles are to be inserted, the skin should have been carefully cleansed, so as to render it as nearly aseptic as possible. Through each needle about a pint of fluid per hour will flow into the cellular tissue. In this way from fifteen to twenty pints can be introduced in twenty-four hours. The infusion can be repeated day after day as occasion demands. The indication for stopping it is that the patient is able to keep down large draughts of fluid by the mouth, or to retain large fluid enemata.

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[1] *Clinical Journal*, vol. xxii., 1903.

The rationale of this treatment is as follows. In this disease, owing to the vomiting and the little fluid ingested, the body is very short of water; and without water, protoplasm cannot do its work; the leucocytes cannot combat the microbes. These injections supply the needed water.

Secondly, while the blood is short of water, there is every inducement for the microbe-laden exudation in the peritoneum to pass into the blood. The introduction of so much fluid into the blood alters the relations, so that instead of the current being from peritoneum to blood vessels, it is from blood vessels to peritoneum. This is shown by the increased discharge in cases in which drainage has been used.

Thirdly, the injections dilute the toxins, and there is reason to think that this renders them less harmful.

No treatment can be expected to succeed if it is postponed until the patient is moribund. It is so difficult when symptoms of peritonitis begin to say whether the peritonitis will remain local, or become general, that the answer may always be made to those who think that they have seen life saved by this or that treatment, that they were wrong in their estimate of the gravity of the case, and that it was one which would have recovered under any treatment. This is an answer which at present holds good against any attempt at statistical disproof. There are, however, three reasons which seem to me good ones for thinking that the benefit which has followed saline injections is really due to them. First, there is great immediate improvement in the patient's appearance and in the pulse. Second, surgeons of experience have seen cases in which they judged that general peritonitis was present and that the prognosis was hopeless, recover after these injections. Third, cases have been observed in which patients suffering from symptoms of general peritonitis have been kept alive by these injections for eight or ten days, when the disease has ended suddenly by crisis; the temperature falling, all other symptoms abating, and recovery then going on without a check: a termination seen after no other treatment.

As patients with peritonitis die by cardiac failure, it is generally recommended to treat them with cardiac stimulants, alcohol and strychnia. This is doubtless proper, but a patient who is constantly vomiting cannot keep down alcohol. I have never known or heard of a case of general peritonitis cured by alcohol or strychnia.

Intestinal Obstruction.—In these cases during the first two days the patient seems to be doing well. The vomiting from the anæsthetic may cease, and then about the third or fourth day vomiting may recommence; or it may never quite cease, but become worse on the third or fourth day. With the persistent vomiting there is constipation, and there is abdominal distension. The pulse rises; the temperature may rise slightly. The rise of the pulse is after the vomiting and distension have long persisted; not before it, as in peritonitis. These symptoms may be present, and steadily increase, even though a little flatus, and even a little fæcal matter, be passed *per anum*, showing that the cause of the symptoms is not simply a mechanical blocking of the bowel. The sequence of events probably is, first fixing of the bowel by adhesion in a kinked condition; then stoppage of onward movement of bowel contents; next, the production of ptomaines in the arrested bowel contents; lastly, poisoning of the patient and paralysis of the bowel by ptomaines. The urgent need of the patient is to get rid of the ptomaines. Theoretically, the best treatment would be to re-open the wound, liberate the adherent bowel, and so remove the cause of mischief; and this has been done with occasional success. There is more hope of easily freeing adherent bowel in this form of obstruction than in many others, because it is known that in nine cases out of ten of obstruction following an intrapelvic operation the seat of obstruction is in the sigmoid flexure. But actually, when the patient is so bad that there is no doubt as to the diagnosis, the severe operation of searching for the obstruction and liberating the bowel is generally fatal. The safer course is to open up a couple of inches of the wound, pick up the first distended piece of bowel that is seen, fasten it to the margins of the wound by two stitches, and then open it. This will give exit to the foul contents. I have known after this has been done, not only the distension be relieved, vomiting cease, and pulse and temperature fall, but the bowels act naturally, and the artificial anus spontaneously close. But even if natural action of the bowels follows not the relief of distension, the operation of searching for the seat of obstruction is attended with comparatively little danger when the pulse and temperature have become normal, and the bowels are regularly evacuated through the artificial anus.

As after child-bearing, so after operations, *thrombosis* of veins is an occasional sequel. Were I to judge by my own experience, I should say it occurs chiefly in patients who are very anæmic when the operation is done. But others have not observed this association; and it is to be remarked that after long-continued hæmorrhage without operation thrombosis is rare. Some see in it an effect of septic poisoning; but in the cases I have seen, as in most cases of puerperal phlegmasia dolens, there has been no other evidence of septic poisoning. Thrombosis may affect the femoral and external iliac veins, producing painful œdema of the leg, which may last a few days, weeks, or even months. A clot may be detached, and produce pulmonary embolism. As in the puerperal state, sudden death from pulmonary embolism may occur in a patient who seemed to be going on well.

We know not how to prevent thrombosis of veins after operations, for we know little or nothing of its causes. When it has occurred the only treatment is to relieve pain and to assist the return of blood as much as possible by keeping the patient recumbent, and the limb elevated and warm: this is best done by wrapping it in cotton wool or Gamgee tissue. The patient and her friends must be cautioned against rubbing the limb, on account of the danger of detaching the clot. The best way of relieving pain is to paint on the painful part a solution of oleate of morphia in olive oil, as strong as is necessary; and if this prove inadequate, by the hypodermic injection of morphia.

Parotitis.—There is a close relation between the genital organs and the parotid gland. The occasional metastasis of mumps to the male genital gland is well known. Parotitis may occur after any injury or disease; but it is ten times commoner after injury or disease affecting the pelvic contents than after injury or disease of other parts.[1] When occurring after injury not affecting the pelvis it is generally pyæmic, and accompanied with other abscesses elsewhere; but that which arises after a pelvic operation, though it may be pyæmic, yet usually is not. The only explanation we have of it is that it is a nervous phenomenon, allied to the salivation of pregnancy, and the thirst and gastric catarrh which follow abdominal section. It has no fixed period of incubation, though it usually comes on within three weeks. Sometimes there are rigors with high fever, but generally not. Usually one gland only is affected, but both may be. The gland suppurates in rather more than half the cases. Suppuration and high fever occur in the old, the weak, and those who from some other complication are doing badly and are likely to die. Death solely from parotitis is rare. When the gland has suppurated it may burst into the auditory meatus, or into the mouth, or it may burrow back over the mastoid process or down into the neck.

The only treatment is to protect the tender part from painful pressure by covering it with cotton wool or Gamgee tissue, and to let out the pus early. If there is great swelling and tension, an incision will relieve even though pus has not yet formed.

Insanity.—In patients who have inherited or acquired nervous instability from unfavourable circumstances during growth and development, there is danger lest the strain upon the nervous system involved in a great operation may produce insanity. I know not any estimate of the frequency with which insanity follows abdominal operations, but it is probably not less frequent after operations than after child-bearing. I know not that any particular operation is more likely than another to be followed by insanity. It is due to conditions which we cannot greatly alter, though we should do what we can. It is produced by the anxiety and fear of looking forward to the operation, followed by the want of food, pain, and often sleeplessness, which mark the days after the operation. Under conditions of strain of other kinds the way in which we may hope to prevent insanity is by taking care to secure to the patient plenty of food and sleep, and in the case of an operation we should act on the same lines. In the case of a patient whose mental habit is such that there is fear lest an operation should be followed by insanity, special care should be taken that she shall eat and sleep well during the days preceding the operation. The operation should be performed as soon as possible after the necessity for it has been announced. The day and hour should be communicated to the patient as late as possible. After the operation special care should be taken to keep the patient supplied frequently with food; by nutrient enemata so long as she is unable to keep food in the stomach, and by as liberal a diet as possible when she is able to take it. Great care should be taken to ensure sleep, by hypodermic injections of morphia while she is unable to take medicines by the mouth, then by such medicine. In wakefulness due not to pain but to the nervous condition of the patient, the best of all sedatives is alcohol, in the form of port, sherry, brandy, or whisky. The hypnotic effect will be helped by the addition of hot water. If there are objections in the particular case to the use of alcohol, sleep should be secured by trional, chloralamide, or rectal injections of paraldehyde. By some means or other regular sleep at night should be secured. These necessities are not only the essential, but the only things that we can do to prevent insanity. If in spite of care the patient becomes insane, the principles of treatment are the same as in insanity from any other cause.

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[1] See Stephen Paget, *Brit. Med. Journal*, vol. i., 1887.

Neurasthenia.—Every severe operation makes the patient more or less neurasthenic for a time. The late Mr. Knowsley Thornton used to tell his patients that they would not be themselves for a year after ovariotomy. I should replace "a year" by "six months," and then agree. Therefore, a patient after a major operation should not be allowed at once to take on the stress of domestic and social duty, but should be sent first to a convalescent home or a suitable health resort, where she may recuperate her nervous energy.

II. **Vaginal Hysterectomy.**—Much that has been said about the after-treatment of cases of abdominal section applies here also, viz. what has been said about feeding, recumbency, bowels, pulse, and temperature.

As after abdominal section, the first danger in point of time is hæmorrhage, either from defective hæmostasis during the operation, or from slipping of forceps or ligatures which were secure when the patient was put back to bed. But here the bleeding is not internal, but escapes by the vagina. Immediately after the operation a clean pad of Gamgee tissue should be put to the vulva and another underneath the patient, and during the few hours following the operation the nurse should inspect these pads, at first every ten minutes, after the first hour every half-hour, and after three hours less frequently, in order to see if there is hæmorrhage. It is seldom that hæmostasis is so perfect that there is not some oozing of blood, but there ought not to be enough to affect the pulse, and it ought to be less and less each time the pad is inspected. The pads should be changed when much soiled.

Should there be much bleeding, the only treatment is to anæsthetise the patient, put her in the lithotomy position, and, with the help of specula and retractors, search for and secure the bleeding point or points.

Peritonitis is the next danger. Some adhesive peritonitis always follows, and is the means whereby the wound in the peritoneum is closed. The operation may be followed by local peritonitis going on to the formation of pus, or general infective peritonitis may follow. What has been said about peritonitis following abdominal section applies also here, except that if symptoms of suppurative peritonitis are present search should be made for the pus by the vagina only. The patient should be anæsthetised, and wherever a swelling can be felt, adhesions should be broken down and the pus let out.

Intestinal obstruction is rare after vaginal hysterectomy. Should it occur it should be treated as when it occurs after abdominal section.

Effects of Clamps and Ligatures.—Some operators secure hæmostasis by applying pressure forceps, which are left on for forty-eight hours. During this time the patient's legs are tied together, lest by movement she should disturb the forceps. The drawback of this method is that the constant dragging at the tissues by the forceps which hold them in their grasp causes pain bad enough to require morphia, until the forceps have been removed. The removal of the forceps does not much increase the pain, and when this has been done pain soon subsides. The advantages of this method are that the forceps keep open a channel by which discharge can escape, so that pent-up pus is rarely met with after their use, and that there is nothing to keep up discharge, as ligatures sometimes do. Some operators prevent hæmorrhage by tying the vessels, and often a good deal of tissue with them, with silk ligatures. When these are used the state of the patient during the first two days is far more comfortable than when clamps are applied; recovery may be almost painless. But although the peritoneum can encapsule and absorb silk ligatures, the cellular tissue has not this power. Too often, after the patient has in other respects completely recovered, discharge from the vagina is kept up by the ligatures; and if so, the patient must be anæsthetised, and the ligatures sought for and removed.

Drainage.—If the large vessels are not secured the patient quickly dies. But many small vessels in the vagina and cellular tissue are wounded in this operation, and from these oozing of blood takes place. If this oozing is small in quantity the operator knows it will cease in a few hours, and therefore if he is a person of good judgment he does not prolong the anæsthesia in the unnecessary task of hunting for every small vessel. There are circumstances, such as defective light, or inefficient assistance, which may make it unusually difficult to find and secure bleeding points, and therefore sometimes an operator finds himself compelled to terminate an operation while there is yet more oozing than he likes. In such cases natural hæmostasis is often helped by plugging the wound with iodoform gauze. The gauze mechanically aids the clotting of blood, and the iodine given off acts as an antiseptic. Some think it desirable to insert gauze for the latter reason alone, even when bleeding has been satisfactorily stopped. When gauze has been used its removal is an important part of the after-treatment. If part of it protrudes from the vagina this part will probably get soaked with urine, and in time will smell offensive. Therefore such part as protrudes from the vagina should be cut away with scissors on the second or third day following the operation. The part within the vagina should be left untouched for eight or ten days. During the two or three days following the operation the gauze becomes adherent to any raw surface or bowel with which it is in contact. Its removal at this time is horribly painful to the patient, and if it be removed under anæsthesia, bowel may be pulled down with it; but by the end of ten days the gauze is surrounded with pus, is completely detached, and can be withdrawn without pain or detriment.

In other respects than these the after-treatment is the same as that of cases of abdominal section.

III. **The Operation for Complete Rupture of the Perineum.**—The after-treatment here consists in (1) keeping the parts clean, (2) preventing constipation, (3) removing the sutures.

Some, of whom I am one, think that the parts are less likely to be dragged upon, and healing therefore more likely to be undisturbed, if the patient's legs are tied together. Some think that this is not important.

(1) The part is kept clean by bathing it twice daily with an unirritating antiseptic, so as to wash away all discharge. The best for the purpose is a solution of boric acid applied with a swab of clean absorbent wool.

(2) It was at one time thought necessary after an operation for complete rupture of the perineum to confine the bowels by opium and astringent medicines. When this practice was followed it sometimes happened that the first time the bowels acted after the operation a scybalum of such size and hardness was propelled through the anus that it broke down the recently united surfaces. This accident is avoided by washing out the rectum night and morning. A catheter, having a funnel connected to it by india-rubber tubing, is passed through the anus, and by it three or four ounces of water are poured into the rectum. This small injection is not immediately returned, and will soften any hard stuff that may have come down. If the water each time comes back so clear that it seems as if the bowel cannot be properly cleared out, a saline purge should be given every other morning, but this is seldom necessary.

(3) The time at which to take out the stitches depends on the material used, and the amount of tension put upon them. The part should be examined at the end of a week. If there has been much swelling, and the ligatures have so far cut their way through the tissues as to lie loosely, they should be removed. If this is not the case they

may be left a day or two longer. Silkworm gut and wire may be left longer than most other suture materials. Healing is generally complete at the end of three weeks. The patient, if married, should be instructed not to resume marital relations for six weeks.

Retention of urine is frequent as a reflex effect of the suture of a ruptured perineum. It must be relieved with the catheter.

IV. **Colporrhaphy.**—The after-treatment of colporrhaphy simply consists in keeping the patient recumbent until healing is nearly complete, keeping the parts clean with vaginal douches twice daily of some unirritating antiseptic, such as a saturated (or nearly so) solution of boric acid, and taking out the stitches at the proper time, judging what is the proper time in the same way as after the operation for rupture of the perineum.

V. **Minor Gynæcological Operations.**—The after-treatment of the minor gynæcological operations, such as dilatation, curetting, the removal of polypi, and of urethral caruncles, simply consists in keeping the patient clean, and keeping her recumbent so long as local discomfort persists. Many persons after removing a fibroid polypi would keep the patient recumbent for a week or more, but I know of no harm that results from letting such a patient get up as soon as her feeling of strength and well-being makes her wish to do so. There are some who, after curetting, pack the uterus with iodoform gauze, and after dilatation for dysmenorrhœa make the patient wear an intra-uterine stem; but these additions to the operation are in my opinion unnecessary, and introduce an element of danger.

G. Ernest Herman.

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